



**US Army Corps  
of Engineers**  
Kansas City District  
*You Matter - We Care*

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# **Basic Combat Training Trainee Barracks, FY 01**

## **Fort Leonard Wood, Missouri**

### **Volume I of II**

### **Construction Solicitation and Specifications**

**July 2001**

DEPARTMENT OF THE ARMY  
 Kansas City District, Corps of Engineers  
 757 Federal Building  
 Kansas City, Missouri 64106

SPECIFICATIONS FOR CONSTRUCTION OF  
 BASIC COMBAT TRAINING  
 TRAINEE BARRACKS, FY 01  
 FORT LEONARD WOOD, MISSOURI

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<b>SOLICITATION, OFFER, AND AWARD</b>  <b>(Construction, Alteration, or Repair)</b>		1. SOLICITATION NO.	2. TYPE OF SOLICITATION	3. DATE ISSUED	PAGE OF	PAGES
		DACA41-01-R-0012	<input type="checkbox"/> SEALED BID (IFB) <input checked="" type="checkbox"/> NEGOTIATED (RFP)	7/30/2001	1	
IMPORTANT - The "offer" section on the reverse must be fully completed by offeror.						
4.		5. REQUISITION/PURCHASE REQUEST NO.		6. PROJECT NO.		
				47501 & 53439		
7. ISSUED BY		CODE	8. ADDRESS OFFER TO			
U.S. Army Engineer District, Kansas City 760 Federal Building, 601 E. 12th Street Kansas City, Missouri 64106-2896  Tel: (816) 983-3802 Fax: (816) 426-5169			See Item 7			
9. FOR INFORMATION CALL:		A. NAME	B. TELEPHONE NO. (Include area code)		(NO COLLECT CALLS)	
		Pamela Wellons	816-983-3802 Ext.			

### SOLICITATION

NOTE: In sealed bid solicitation "offer" and "offeror" mean "bid" and "Bidder".

10. THE GOVERNMENT REQUIRES PERFORMANCE OF THE WORK DESCRIBED IN THESE DOCUMENTS (Title, identifying no., date):

Basic Combat Training  
 Trainee Barracks, FY 01  
 Fort Leonard Wood, Missouri

Description of work: Work will include, but not be limited to, construction of five (5) barracks buildings of approximately 60,000 sq.ft. each, a headquarters/administration building, a dining facility capable of feeding 1,200 trainees plus cadre at each meal period, and a central chilling plant sized to support an additional battalion complex. Buildings will be steel-frame with brick veneer. Work will also include 27 acres of site work, asphalt paving, parking, a service road, prime electrical power, and exterior training facilities.

11. The Contractor shall begin performance within <u>10</u> calendar days and complete it within <u>**</u> calendar days after receiving <input type="checkbox"/> award <input checked="" type="checkbox"/> notice to proceed. This performance period is <input checked="" type="checkbox"/> mandatory, <input type="checkbox"/> negotiable. ** See 00800 )	
12A. THE CONTRACTOR MUST FURNISH ANY REQUIRED PERFORMANCE AND PAYMENT BONDS? (If "YES", indicate within how many calendar days after award in Item 12B.) <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	12B. CALENDAR DAYS  10
13. ADDITIONAL SOLICITATION REQUIREMENTS:	
A. Sealed offers in original and <u>one</u> copies to perform the work required are due at the place specified in Item 8 by <u>1:00 p.m.</u> local time <u>8/30/2001</u> (date). If this is a sealed bid solicitation, offers will be publicly opened at that time. Sealed envelopes containing offers shall be marked to show the offeror's name and address, the solicitation number, and the date and time offers are due.	
B. An offer guarantee <input checked="" type="checkbox"/> is, <input type="checkbox"/> is not required. NOT TO EXCEED <u>20%</u> OF TOTAL BID AMOUNT	
C. All offers are subject to the (1) work requirements, and (2) other provisions and clauses incorporated in the solicitation in full text or by reference.	
D. Offers providing less than <u>90</u> calendar days for Government acceptance after the date offers are due will not be considered and will be rejected.	

00010-1

NSN 7540-01-155-3212

1442 102

**STANDARD FORM 1442** (REV. 4-85)  
 Prescribed by GSA  
 FAR (48 CFR) 53.236-1(d)

**OFFER** *(Must be fully completed by offeror)*

14. NAME AND ADDRESS OF OFFEROR <i>(Include ZIP Code)</i>	15. TELEPHONE NO. <i>(Include area code)</i>
	(FAX # )
	16. REMITTANCE ADDRESS <i>(Include only if different from Item 14)</i>
DUNS NO:	
CODE	FACILITY CODE

17. The offeror agrees to perform the work required at the prices specified below in strict accordance with the terms of this solicitation, if this offer is accepted by the Government in writing within 90 calendar days after the date offers are due. *(Insert any number equal to or greater than the minimum requirement stated in Item 13D. Failure to insert any number means the offeror accepts the minimum in Item 13D.)*

AMOUNTS: See attached Proposal Schedule.

18. The offeror agrees to furnish any required performance and payment bonds.

## 19. ACKNOWLEDGEMENT OF AMENDMENTS

*(The offeror acknowledges receipt of amendments to the solicitation - give number and date of each)*

AMENDMENT NO.								
DATE								

20A. NAME AND TITLE OF PERSON AUTHORIZED TO SIGN OFFER <i>(Type or print)</i>	20B. SIGNATURE	20C. OFFER DATE
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**AWARD** *(To be completed by Government)*

21. ITEMS ACCEPTED

22. AMOUNT	23. ACCOUNTING AND APPROPRIATION DATA	
24. SUBMIT INVOICES TO ADDRESS SHOWN IN <i>(4 copies unless otherwise specified)</i>	ITEM	25. OTHER THAN FULL AND OPEN COMPETITION PURSUANT TO
26. ADMINISTERED BY	CODE	<input type="checkbox"/> 10 U.S.C. 2304(c) ( ) <input type="checkbox"/> 41 U.S.C. 253(c) ( )
		27. PAYMENT WILL BE MADE BY

## CONTRACTING OFFICER WILL COMPLETE ITEM 28 OR 29 AS APPLICABLE

<input type="checkbox"/> 28. NEGOTIATED AGREEMENT <i>(Contractor is required to sign this document and return _____ copies to issuing office.)</i> Contractor agrees to furnish and deliver all items or perform all work requirements identified on this form and any continuation sheets for the consideration stated in this contract. The rights and obligations of the parties to this contract shall be governed by (a) this contract award, (b) the solicitation, and (c) the clauses, representations, certifications, and specifications incorporated by reference in or attached to this contract.	<input type="checkbox"/> 29. AWARD <i>(Contractor is not required to sign this document)</i> Your offer on this solicitation is hereby accepted as to the items listed. This award consummates the contract, which consists of (a) the Government solicitation and your offer, and (b) this contract award. No further contractual document is necessary.	
30A. NAME AND TITLE OF CONTRACTOR OR PERSON AUTHORIZED TO SIGN <i>(Type of print)</i>	31A. NAME OF CONTRACTING OFFICER <i>(Type or print)</i>	
30B. SIGNATURE	31b. UNITED STATES OF AMERICA	31C. AWARD DATE

STANDARD FORM 1442 BACK (REV. 4-85)

## SECTION 00010 Solicitation Contract Form

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0001	<b>Basic Training Complex Phase I</b>	1.00	Lot		
	FFP - Construct Battalion Headquarters, Dining Facility, Chiller Plant (cooling towers), lawn maintenance building and Trainee Barracks Buildings 932 & 939 complete with utility connections and site work to the five-foot line plus all internal features except furnishings. Provide project (rough) site grading, retaining walls, erosion control, primary and site utilities including storm sewers, sanitary sewers, water distribution system, chilled water lines, site electrical and paving, except as noted in other proposal items.				
	PURCHASE REQUEST NUMBER W58XUW-1116-5139			NET AMT	
ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0002	<b>OPTION 1 - Basic Training Complex, Phase II</b>	1.00	Lot		
	FFP - Construct Trainee Barracks Buildings 934, 936 and 937 complete, with utility connections and site work to the five-foot line, plus all internal features except furnishings. Include the following site work in this proposal item: final grading of entire site, Physical Training Pits including subdrain system, Basic Rifle Marksmanship (BRM) Pits, running track, asphalt outer service road including adjacent parking areas and all other work required by the contract and not included in Item No. 0001 or other options.				
				NET AMT	
ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0003	<b>OPTION 2 - Primary Electric Line</b>	1.00	Lot		
	FFP - Primary electrical distribution line from Substation 3 up to, but not including, the building service transformers.				
				NET AMT	
ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0004	<b>OPTION 3 - Communication Option</b>	1.00	Lot		
	FFP - Communications Option comprising a manhole and duct system from the Dial Central Office (Building Number 404) to Manhole 115I.				
				NET AMT	
ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0005	<b>OPTION 4 - Widen Service Road</b>	1.00	Lot		
	FFP - Increase width of service road from 16 feet to 20 feet.				
				NET AMT	

ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0006		1.00	Lot		
<b>OPTION 5 - Phase I Furniture</b>					
FFP - All furnishings for Battalion Headquarters Building, Chiller Plant and Trainee Barracks Buildings 932 and 939.					
NET AMT					<hr/>
ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0007		1.00	Lot		
<b>OPTION 6 - Dining Facility Furniture and Equipment</b>					
FFP - All furnishings and food service equipment for Dining Facility.					
NET AMT					<hr/>
ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0008		1.00	Lot		
<b>OPTION 7 - Phase II Furniture</b>					
FFP - All furnishings for Trainee Barracks Buildings 934, 936, and 937.					
NET AMT					<hr/>
ITEM NO	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0009		1.00	Lot		
<b>OPTION 8 - Booster Pump Station</b>					
FFP - Construct Booster Pump Station (Drawing Volume 6) excluding distribution piping from pump discharge.					
NET AMT					<hr/>

CLAUSES INCORPORATED BY FULL TEXT

#### FIELD OFFICE OVERHEAD

NOTICE TO BIDDERS: For your bid to be responsive, you must declare below the single accounting practice that you apply to contracts to calculate field office overhead for all change orders, modifications and requests for equitable adjustment. Pursuant to Federal Acquisition Regulations (FAR) Parts 31.105(d)(3) and 31.203(d)(1), an accounting practice that varies from modification to modification is not allowable. Select one of the following:

1. TIME DISTRIBUTION BASE FOR A PER DIEM RATE

If you use this practice, see Special Clause "Field Office Overhead Per Diem Rate" \_\_\_\_\_

2. DIRECT COST DISTRIBUTION BASE FOR A PERCENTAGE MARKUP

If you use this practice, see Special Clause "Field Office Overhead Percentage Markup" \_\_\_\_\_

3. OTHER ACCOUNTING PRACTICE THAT IS ALLOWABLE  
UNDER THE FAR AND THAT USES A SINGLE DISTRIBUTION BASE.

YOU MUST DESCRIBE THE ACCOUNTING PRACTICE IN SUFFICIENT DETAIL BELOW TO ALLOW THE CONTRACTING OFFICER TO DETERMINE WHAT ACCOUNTING PRACTICE IS BEING UTILIZED BY YOUR COMPANY AND THAT IT COMPLIES WITH THE FAR.

**FAILURE TO FULLY COMPLY WITH THE ABOVE REQUIREMENT OR, IF ALTERNATIVE 3 IS DECLARED AND YOUR DESCRIPTION DOES NOT CLEARLY STATE OR DESCRIBE A CONSISTENT ACCOUNTING PRACTICE USING A SINGLE DISTRIBUTION BASE, WILL BE CAUSE FOR YOUR BID TO BE REJECTED AS NON-RESPONSIVE.**

NOTES:

- (1) Construction Quick Start: It is the Government's desire that construction commence as soon as practical after Notice to Proceed. To this end, each offeror is required to submit
  - Construction schedule for first 90 days of operations (25 work items or less).
  - Safety plan for first 90 days of operations.
  - Temporary power plan for construction site.

Upon contract award, the information provided by the successful offeror will be reviewed for sufficiency and approved to initiate operations.
- (2) To further enable the contractor to initiate construction in a timely manner, the Government will provide expedited shop drawing review for up to 15 submittals in a 21 day time frame. The 15 shop attention is directed to SECTION 00120 PROPOSAL EVALUATION AND CONTRACT AWARD for further details.
- (3) Offeror's attention is directed to SECTION 00110 SUBMISSION REQUIREMENTS AND INSTRUCTIONS for details concerning the Quick Start requirement.
- (4) All extensions of the unit prices shown will be subject to verification by the Contracting Officer. In case of variation between the unit price and the extension, the unit price will be considered to be the offer.
- (5) If a modification to an offer is submitted which provides for a lumpsum adjustment to the total cost, the application of the lump sum adjustment to each price in the Proposal Schedule must be stated. If it is not stated, the offeror agrees that the lump sum adjustment shall be applied on a pro rata basis to every price in the Proposal Schedule.
- (6) Offeror's attention is directed to SECTION 00100 paragraph titled "Arithmetic Discrepancies" wherein are procedures for correction of errors.

- (7) Offeror's attention is directed to SECTION 01100: GENERAL for special provisions pertaining to this Solicitation.
- (8) Offeror's attention is directed to SECTION 01100, paragraph titled "Missouri Sales and Use Tax".
- (9) The general outline of the principal features of each item as listed does not in any way limit the responsibility of the offeror for making a thorough investigation of the drawings and specifications to determine the scope of work included in each item.
- (10) Offeror's attention is directed to the CONTRACT CLAUSES wherein the apparent low offeror is required to submit a subcontracting small business and small disadvantaged business subcontracting plan. The subcontracting plan shall be submitted on the form which appears at the end of SECTION 00600. Submission of the plan is required prior to award. Award will not be made under this solicitation before the plan is approved by the Contracting Officer.
- (11) Determination of the low offeror will be based on the TOTAL OF THE BASE SCHEDULE PLUS THE OPTION SCHEDULE. Award will be made of the BASE SCHEDULE ONLY. At the option of the Government, the OPTION SCHEDULE may be awarded at the proposal price after Notice of Award for the BASE SCHEDULE work. The Government does not guarantee award of any work beyond that in the BASE SCHEDULE. The Government reserves the right to exercise the OPTION SCHEDULE at the proposal price for each option within the times indicated below. Offeror's attention is directed to SECTION 00100, paragraph titled "Evaluation of Options" for further details.
  - Option 1: Basic Training Complex, Phase II: 180 calendar days from contractor receipt of the Notice to Proceed.
  - Option 2: Primary Electrical Line: 180 calendar days from contractor receipt of the Notice to Proceed.
  - Option 3: Communication Option: 180 calendar days from contractor receipt of the Notice to Proceed.
  - Option 4: Widen Service Road: 180 calendar days from contractor receipt of the Notice to Proceed.
  - Option 5: Phase I Furniture: 400 calendar days from contractor receipt of the Notice to Proceed.
  - Option 6: Dining Facility Furniture and Equipment: 180 calendar days from contractor receipt of the Notice to Proceed.
  - Option 7: Phase II Furniture: 400 calendar days from contractor receipt of the Notice to Proceed.
  - Option 8: Booster Pump Station: 180 calendar days from contractor receipt of the Notice to Proceed.
- (12) Offeror's attention is directed to the CONTRACT CLAUSES, FAR 52.223-9, Certification and Estimate of Percentage of Recovered Material Content for EPA -Designated Items. Certification will be required upon contract completion unless a waiver has been approved by the Contracting Officer. The waiver must be approved prior to contract award.

# CAUTION!

BEFORE SIGNING AND MAILING THIS PROPOSAL, please take note of the following, as failure to perform any one of these actions may cause your offer to be rejected.

1. AMENDMENTS: Have you acknowledged receipt of ALL Amendments? If in doubt as to number of amendments issued, please contact our office.
2. SEALED PROPOSALS: Sealed envelopes containing proposals shall be marked to show the offeror's name and address, the solicitation number, amendments received, and the date and time proposals are due.
3. AMENDED PROPOSAL PAGES: If any of the Amendments furnished amended proposal pages, the amended proposal pages must be used in submitting your proposal.
4. LATE PROPOSALS: In order for a late mailed proposal to be considered, generally it must have been sent by either registered or certified mail not later than 5 calendar days before the receipt of proposals date.
5. PROPOSAL GUARANTEE: Sufficient proposal guarantee in proper form must be furnished with your proposal, if your proposal exceeds \$50,000.
6. MISTAKE IN PROPOSAL: Have you reviewed your proposal prices for possible errors in calculations or work left out?
7. TELEGRAPHIC MODIFICATIONS: If you modify your proposal by telegram, be sure to allow sufficient time for the telegram to reach us prior to the time set for receipt of proposals. Any doubt should be resolved in favor of allowing Extra Time.
8. FACSIMILE PROPOSALS, MODIFICATIONS, OR WITHDRAWALS: Will not be considered.
9. SECTION 00600: Certifications must be completed and submitted with your proposal. Small Business and Small Disadvantaged Business Subcontracting Plan, found at the end of Section 00600, must be submitted with your proposal.
10. HAND-DELIVERED PROPOSAL: If proposals are hand-delivered, you must be aware of security requirements in effect in the Federal Building. No additional time will be allowed due to security requirements.
11. BUY AMERICAN ACT: All offerors are cautioned that, prior Government conduct notwithstanding, the Contractor's selection of a domestic construction material (as defined in SECTION 00700) which would require the subsequent selection of a foreign construction material for compatibility is not a justification for waiver of the Buy American Act. It is the Contractor's responsibility to verify, prior to submitting the materials for approval, that each system can be built to meet the contract specifications without the use of foreign construction materials.

## SECTION 00100 Bidding Schedule/Instructions to Bidders

## CLAUSES INCORPORATED BY REFERENCE:

52.204-6	Data Universal Numbering System (DUNS) Number	JUN 1999
52.214-34	Submission Of Offers In The English Language	APR 1991
52.214-35	Submission Of Offers In U.S. Currency	APR 1991
52.215-16	Facilities Capital Cost of Money	OCT 1997
52.215-20	Requirements for Cost or Pricing Data or Information Other Than Cost or Pricing Data	OCT 1997
52.225-12	Notice of Buy American Act Requirement - Construction Materials Under Trade Agreements	FEB 2000

## CLAUSES INCORPORATED BY FULL TEXT

**BID BOND REQUIREMENTS (DEC 1989) (FAR 28.101-2):** If your bid exceed \$50,000.00, the bid bond shall be in the amount of 20% of the bid price of \$3,000,000, whichever is the lesser amount. (See CONTRACT CLAUSE titled "Bid Guarantee.")

**FIELD OFFICE OVERHEAD PERCENTAGE MARKUP**

If any change to the contract, issued pursuant to the changes Clause or otherwise, for which the Government is responsible, causes an increase or decrease in the Contractor's cost of, of the time required for, performance under the contract, the Contracting Officer shall make an equitable adjustment and modify the contract in writing.

Under such equitable adjustment, no per diem rate for field office overhead shall be allowed if the Contractor has elected a percentage markup in keeping with its standard accounting practices. In such a case, payment of field office overhead shall be allowed for any change on a percentage markup basis regardless of whether the completion of the contract is or is not extended by reason of the change, except for modifications issued pursuant to the Default Clause. The Contractor shall provide a detailed breakdown of its proposed increase or decrease of costs as required by Contract Clause DFARS 252.236-7001 MODIFICATION OF PROPOSALS – PRICE BREAKDOWN.

**FIELD OFFICE OVERHEAD PER DIEM RATE**

If any change to the contract, issued pursuant to the Changes Clause or otherwise, for which the Government is responsible, causes an increase or decrease in the Contractor's cost of, or the time required for, performance under the contract, the Contracting Officer shall make an equitable adjustment and modify the contract in writing.

Under such equitable adjustment, no payment of field office overhead shall be allowed for any changes when the completion of the contract is not extended by reason of the change, except the Contractor may be reimbursed any variable expense it incurs due to the change, provided it can substantiate the variables. The Contractor shall be reimbursed for field office overhead on a per diem basis when the completion of the contract is extended by reason of the change issued under any clause except the Default clause. Equitable adjustment shall be made for the costs that are incurred or are to be incurred due to the change. The Contractor shall provide a detailed breakdown of its proposed increase or decrease of costs as required by Contract Clause DFARS 252.236-7001 MODIFICATION OF PROPOSALS – PRICE BREAKDOWN.



## PLANS AND SPECIFICATIONS

Plans and specifications will be available only on CD-ROM, and will be free of charge. A street address must be provided when requesting a CD-ROM. Requests for the CD-ROM must be made via the Internet at <http://www.nwk.usace.army.mil/contract/contract.html>.

THE MAGNITUDE OF THIS PROJECT IS REPRESENTED BY THE FOLLOWING ESTIMATED PRICE RANGE (See FAR 36.204): More than \$10,000,000.

### 52.211-14 NOTICE OF PRIORITY RATING FOR NATIONAL DEFENSE USE (SEP 1990)

Any contract awarded as a result of this solicitation will be ☐ DX rated order; ☒ DO rated order certified for national defense use under the Defense Priorities and Allocations System (DPAS) (15 CFR 700), and the Contractor will be required to follow all of the requirements of this regulation. [Contracting Officer check appropriate box.]

(End of provision)

### 52.214-5000 ARITHMETIC DISCREPANCIES (MAR 1995)

- (a) For the purpose of initial evaluation of bids, the following will be utilized in resolving arithmetic discrepancies found on the face of the bidding schedule as submitted by the bidder:
- (1) Obviously misplaced decimal points will be corrected;
  - (2) Discrepancy between unit price and extended price, the unit price will govern;
  - (3) Apparent errors in extension of unit prices will be corrected;
  - (4) Apparent errors in addition of lump-sum and extended prices will be corrected.
- (b) For the purpose of bid evaluation, the Government will proceed on the assumption that the bidder intends his bid to be evaluated on the basis of the unit prices, the totals arrived at by resolution of arithmetic discrepancies as provided above and the bid will be so reflected on the abstract of bids.
- (c) These correction procedures shall not be used to resolve any ambiguity concerning which bid is low.

(End of Statement)

### 52.215-1 INSTRUCTIONS TO OFFERORS--COMPETITIVE ACQUISITION (MAY 2001)

(a) Definitions. As used in this provision--

“Discussions” are negotiations that occur after establishment of the competitive range that may, at the Contracting Officer's discretion, result in the offeror being allowed to revise its proposal.

In writing, writing, or written means any worded or numbered expression that can be read, reproduced, and later communicated, and includes electronically transmitted and stored information.

“Proposal modification” is a change made to a proposal before the solicitation's closing date and time, or made in response to an amendment, or made to correct a mistake at any time before award.

“Proposal revision” is a change to a proposal made after the solicitation closing date, at the request of or as allowed by a Contracting Officer as the result of negotiations.

“Time”, if stated as a number of days, is calculated using calendar days, unless otherwise specified, and will include Saturdays, Sundays, and legal holidays. However, if the last day falls on a Saturday, Sunday, or legal holiday, then the period shall include the next working day.

(b) Amendments to solicitations. If this solicitation is amended, all terms and conditions that are not amended remain unchanged. Offerors shall acknowledge receipt of any amendment to this solicitation by the date and time specified in the amendment(s).

(c) Submission, modification, revision, and withdrawal of proposals. (1) Unless other methods (e.g., electronic commerce or facsimile) are permitted in the solicitation, proposals and modifications to proposals shall be submitted in paper media in sealed envelopes or packages (i) addressed to the office specified in the solicitation, and (ii) showing the time and date specified for receipt, the solicitation number, and the name and address of the offeror. Offerors using commercial carriers should ensure that the proposal is marked on the outermost wrapper with the information in paragraphs (c)(1)(i) and (c)(1)(ii) of this provision.

(2) The first page of the proposal must show--

(i) The solicitation number;

(ii) The name, address, and telephone and facsimile numbers of the offeror (and electronic address if available);

(iii) A statement specifying the extent of agreement with all terms, conditions, and provisions included in the solicitation and agreement to furnish any or all items upon which prices are offered at the price set opposite each item;

(iv) Names, titles, and telephone and facsimile numbers (and electronic addresses if available) of persons authorized to negotiate on the offeror's behalf with the Government in connection with this solicitation; and

(v) Name, title, and signature of person authorized to sign the proposal. Proposals signed by an agent shall be accompanied by evidence of that agent's authority, unless that evidence has been previously furnished to the issuing office.

(3) Submission, modification, or revision, of proposals.

(i) Offerors are responsible for submitting proposals, and any modifications, or revisions, so as to reach the Government office designated in the solicitation by the time specified in the solicitation. If no time is specified in the solicitation, the time for receipt is 4:30 p.m., local time, for the designated Government office on the date that proposal or revision is due.

(ii)(A) Any proposal, modification, or revision received at the Government office designated in the solicitation after the exact time specified for receipt of offers is "late" and will not be considered unless it is received before award is made, the Contracting Officer determines that accepting the late offer would not unduly delay the acquisition; and--

(1) If it was transmitted through an electronic commerce method authorized by the solicitation, it was received at the initial point of entry to the Government infrastructure not later than 5:00 p.m. one working day prior to the date specified for receipt of proposals; or

(2) There is acceptable evidence to establish that it was received at the Government installation designated for receipt of offers and was under the Government's control prior to the time set for receipt of offers; or

(3) It is the only proposal received.

(B) However, a late modification of an otherwise successful proposal that makes its terms more favorable to the Government, will be considered at any time it is received and may be accepted.

(iii) Acceptable evidence to establish the time of receipt at the Government installation includes the time/date stamp of that installation on the proposal wrapper, other documentary evidence of receipt maintained by the installation, or oral testimony or statements of Government personnel.

(iv) If an emergency or unanticipated event interrupts normal Government processes so that proposals cannot be received at the office designated for receipt of proposals by the exact time specified in the solicitation, and urgent Government requirements preclude amendment of the solicitation, the time specified for receipt of proposals will be deemed to be extended to the same time of day specified in the solicitation on the first work day on which normal Government processes resume.

(v) Proposals may be withdrawn by written notice received at any time before award. Oral proposals in response to oral solicitations may be withdrawn orally. If the solicitation authorizes facsimile proposals, proposals may be withdrawn via facsimile received at any time before award, subject to the conditions specified in the provision at 52.215-5, Facsimile Proposals. Proposals may be withdrawn in person by an offeror or an authorized representative, if the identity of the person requesting withdrawal is established and the person signs a receipt for the proposal before award.

(4) Unless otherwise specified in the solicitation, the offeror may propose to provide any item or combination of items.

(5) Offerors shall submit proposals in response to this solicitation in English, unless otherwise permitted by the solicitation, and in U.S. dollars, unless the provision at FAR 52.225-17, Evaluation of Foreign Currency Offers, is included in the solicitation.

(6) Offerors may submit modifications to their proposals at any time before the solicitation closing date and time, and may submit modifications in response to an amendment, or to correct a mistake at any time before award.

(7) Offerors may submit revised proposals only if requested or allowed by the Contracting Officer.

(8) Proposals may be withdrawn at any time before award. Withdrawals are effective upon receipt of notice by the Contracting Officer.

(d) Offer expiration date. Proposals in response to this solicitation will be valid for the number of days specified on the solicitation cover sheet (unless a different period is proposed by the offeror).

(e) Restriction on disclosure and use of data. Offerors that include in their proposals data that they do not want disclosed to the public for any purpose, or used by the Government except for evaluation purposes, shall--

(1) Mark the title page with the following legend: This proposal includes data that shall not be disclosed outside the Government and shall not be duplicated, used, or disclosed--in whole or in part--for any purpose other than to evaluate this proposal. If, however, a contract is awarded to this offeror as a result of--or in connection with-- the submission of this data, the Government shall have the right to duplicate, use, or disclose the data to the extent provided in the resulting contract. This restriction does not limit the Government's right to use information contained in this data if it is obtained from another source without restriction. The data subject to this restriction are contained in sheets [insert numbers or other identification of sheets]; and

(2) Mark each sheet of data it wishes to restrict with the following legend: Use or disclosure of data contained on this sheet is subject to the restriction on the title page of this proposal.

(f) Contract award. (1) The Government intends to award a contract or contracts resulting from this solicitation to the responsible offeror(s) whose proposal(s) represents the best value after evaluation in accordance with the factors and subfactors in the solicitation.

(2) The Government may reject any or all proposals if such action is in the Government's interest.

(3) The Government may waive informalities and minor irregularities in proposals received.

(4) The Government intends to evaluate proposals and award a contract without discussions with offerors (except

clarifications as described in FAR 15.306(a)). Therefore, the offeror's initial proposal should contain the offeror's best terms from a cost or price and technical standpoint. The Government reserves the right to conduct discussions if the Contracting Officer later determines them to be necessary. If the Contracting Officer determines that the number of proposals that would otherwise be in the competitive range exceeds the number at which an efficient competition can be conducted, the Contracting Officer may limit the number of proposals in the competitive range to the greatest number that will permit an efficient competition among the most highly rated proposals.

(5) The Government reserves the right to make an award on any item for a quantity less than the quantity offered, at the unit cost or prices offered, unless the offeror specifies otherwise in the proposal.

(6) The Government reserves the right to make multiple awards if, after considering the additional administrative costs, it is in the Government's best interest to do so.

(7) Exchanges with offerors after receipt of a proposal do not constitute a rejection or counteroffer by the Government.

(8) The Government may determine that a proposal is unacceptable if the prices proposed are materially unbalanced between line items or subline items. Unbalanced pricing exists when, despite an acceptable total evaluated price, the price of one or more contract line items is significantly overstated or understated as indicated by the application of cost or price analysis techniques. A proposal may be rejected if the Contracting Officer determines that the lack of balance poses an unacceptable risk to the Government.

(9) If a cost realism analysis is performed, cost realism may be considered by the source selection authority in evaluating performance or schedule risk.

(10) A written award or acceptance of proposal mailed or otherwise furnished to the successful offeror within the time specified in the proposal shall result in a binding contract without further action by either party.

(11) The Government may disclose the following information in postaward debriefings to other offerors:

- (i) The overall evaluated cost or price and technical rating of the successful offeror;
- (ii) The overall ranking of all offerors, when any ranking was developed by the agency during source selection;
- (iii) A summary of the rationale for award; and
- (iv) For acquisitions of commercial items, the make and model of the item to be delivered by the successful offeror.

(End of provision)

#### 52.216-1 TYPE OF CONTRACT (APR 1984)

The Government contemplates award of a firm-fixed price contract resulting from this solicitation.

(End of clause)

#### 52.217-5 EVALUATION OF OPTIONS (JUL 1990)

Except when it is determined in accordance with FAR 17.206(b) not to be in the Government's best interests, the Government will evaluate offers for award purposes by adding the total price for all options to the total price for the basic requirement. Evaluation of options will not obligate the Government to exercise the option(s).

(End of Provision)

**52.222-23 NOTICE OF REQUIREMENT FOR AFFIRMATIVE ACTION TO ENSURE EQUAL EMPLOYMENT OPPORTUNITY FOR CONSTRUCTION (FEB 1999)**

(a) The offeror's attention is called to the Equal Opportunity clause and the Affirmative Action Compliance Requirements for Construction clause of this solicitation.

(b) The goals for minority and female participation, expressed in percentage terms for the Contractor's aggregate workforce in each trade on all construction work in the covered area, are as follows:

Goals for minority participation for each trade	Goals for female participation for each trade
9.1%	5%

These goals are applicable to all the Contractor's construction work performed in the covered area. If the Contractor performs construction work in a geographical area located outside of the covered area, the Contractor shall apply the goals established for the geographical area where the work is actually performed. Goals are published periodically in the Federal Register in notice form, and these notices may be obtained from any Office of Federal Contract Compliance Programs office.

(c) The Contractor's compliance with Executive Order 11246, as amended, and the regulations in 41 CFR 60-4 shall be based on (1) its implementation of the Equal Opportunity clause, (2) specific affirmative action obligations required by the clause entitled "Affirmative Action Compliance Requirements for Construction," and (3) its efforts to meet the goals. The hours of minority and female employment and training must be substantially uniform throughout the length of the contract, and in each trade. The Contractor shall make a good faith effort to employ minorities and women evenly on each of its projects. The transfer of minority or female employees or trainees from Contractor to Contractor, or from project to project, for the sole purpose of meeting the Contractor's goals shall be a violation of the contract, Executive Order 11246, as amended, and the regulations in 41 CFR 60-4. Compliance with the goals will be measured against the total work hours performed.

(d) The Contractor shall provide written notification to the Deputy Assistant Secretary for Federal Contract Compliance, U.S. Department of Labor, within 10 working days following award of any construction subcontract in excess of \$10,000 at any tier for construction work under the contract resulting from this solicitation. The notification shall list the --

- (1) Name, address, and telephone number of the subcontractor;
- (2) Employer's identification number of the subcontractor;
- (3) Estimated dollar amount of the subcontract;
- (4) Estimated starting and completion dates of the subcontract; and
- (5) Geographical area in which the subcontract is to be performed.

(e) As used in this Notice, and in any contract resulting from this solicitation, the "covered area" Pulaski County, Missouri.

**52.228-1 BID GUARANTEE (SEP 1996)**

(a) Failure to furnish a bid guarantee in the proper form and amount, by the time set for opening of bids, may be cause for rejection of the bid.

(b) The bidder shall furnish a bid guarantee in the form of a firm commitment, e.g., bid bond supported by good and sufficient surety or sureties acceptable to the Government, postal money order, certified check, cashier's check, irrevocable letter of credit, or, under Treasury Department regulations, certain bonds or notes of the United States. The Contracting Officer will return bid guarantees, other than bid bonds, (1) to unsuccessful bidders as soon as practicable after the opening of bids, and (2) to the successful bidder upon execution of contractual documents and bonds (including any necessary coinsurance or reinsurance agreements), as required by the bid as accepted.

(c) The amount of the bid guarantee shall be 20 percent of the bid price or \$ 3,000,000, whichever is less.

(d) If the successful bidder, upon acceptance of its bid by the Government within the period specified for acceptance, fails to execute all contractual documents or furnish executed bond(s) within 10 days after receipt of the forms by the bidder, the Contracting Officer may terminate the contract for default.

(e) In the event the contract is terminated for default, the bidder is liable for any cost of acquiring the work that exceeds the amount of its bid, and the bid guarantee is available to offset the difference.

#### 52.233-2 SERVICE OF PROTEST (AUG 1996)

(a) Protests, as defined in section 33.101 of the Federal Acquisition Regulation, that are filed directly with an agency, and copies of any protests that are filed with the General Accounting Office (GAO), shall be served on the Contracting Officer (addressed as follows) by obtaining written and dated acknowledgment of receipt from Charlene A. Points, Contracting Officer, U.S. Army Engineering District Kansas City, Attn: CENWK-CT-C, 760 Federal Building, 601 E 12<sup>th</sup> Street, Kansas City, MO 64106.

(b) The copy of any protest shall be received in the office designated above within one day of filing a protest with the GAO.

(End of provision)

#### 52.236-27 SITE VISIT (CONSTRUCTION) (FEB 1995) – ALTERNATE I (FEB 1995)

(a) The clauses at 52.236-2, Differing Site Conditions, and 52.236-3, Site Investigations and Conditions Affecting the Work, will be included in any contract awarded as a result of this solicitation. Accordingly, offerors or quoters are urged and expected to inspect the site where the work will be performed.

(b) An organized site visit has been scheduled for--  
Wednesday, August 15, 2001 at 1:00 p.m.

(c) Participants will meet at--  
Bldg 1607, Engineer Museum Regimental Room, Fort Leonard Wood, MO

(d) Site visits may be arranged during normal duty hours by contacting:  
Name: Loren Humphrey or John Pruitt  
Mailing Address: Fort Leonard Wood Resident Office, P. O. Box 200, Ft. Leonard Wood, MO 65473  
Physical Address: Bldg. 2204, Fort Leonard Wood, MO  
Telephone: (573) 596-0081

#### 52.236-28 PREPARATION OF PROPOSALS--CONSTRUCTION (OCT 1997)

(a) Proposals must be (1) submitted on the forms furnished by the Government or on copies of those forms, and (2) manually signed. The person signing a proposal must initial each erasure or change appearing on any proposal form.

(b) The proposal form may require offerors to submit proposed prices for one or more items on various bases,

including--

- (1) Lump sum price;
  - (2) Alternate prices;
  - (3) Units of construction; or
  - (4) Any combination of paragraphs (b)(1) through (b)(3) of this provision.
- (c) If the solicitation requires submission of a proposal on all items, failure to do so may result in the proposal being rejected without further consideration. If a proposal on all items is not required, offerors should insert the words “no proposal” in the space provided for any item on which no price is submitted.
- (d) Alternate proposals will not be considered unless this solicitation authorizes their submission.
- (End of provision)

#### 52.252-1 SOLICITATION PROVISIONS INCORPORATED BY REFERENCE (FEB 1998)

This solicitation incorporates one or more solicitation provisions by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. The offeror is cautioned that the listed provisions may include blocks that must be completed by the offeror and submitted with its quotation or offer. In lieu of submitting the full text of those provisions, the offeror may identify the provision by paragraph identifier and provide the appropriate information with its quotation or offer. Also, the full text of a solicitation provision may be accessed electronically at this/these address(es):

<http://www.arnet.gov/far/>  
<http://www.acq.osd.mil/dp/dars/dfars/dfars.html>

#### 252.204-7004 REQUIRED CENTRAL CONTRACTOR REGISTRATION.(MAR 2000)

##### (a) Definitions.

As used in this clause--

- (1) Central Contractor Registration (CCR) database means the primary DoD repository for contractor information required for the conduct of business with DoD.
- (2) Data Universal Numbering System (DUNS) number means the 9-digit number assigned by Dun and Bradstreet Information Services to identify unique business entities.
- (3) Data Universal Numbering System +4 (DUNS+4) number means the DUNS number assigned by Dun and Bradstreet plus a 4-digit suffix that may be assigned by a parent (controlling) business concern. This 4-digit suffix may be assigned at the discretion of the parent business concern for such purposes as identifying subunits or affiliates of the parent business concern.
- (4) Registered in the CCR database means that all mandatory information, including the DUNS number or the DUNS+4 number, if applicable, and the corresponding Commercial and Government Entity (CAGE) code, is in the CCR database; the DUNS number and the CAGE code have been validated; and all edits have been successfully completed.

(b)(1) By submission of an offer, the offeror acknowledges the requirement that a prospective awardee must be registered in the CCR database prior to award, during performance, and through final payment of any contract resulting from this solicitation, except for awards to foreign vendors for work to be performed outside the United States.

(2) The offeror shall provide its DUNS or, if applicable, its DUNS+4 number with its offer, which will be used by the Contracting Officer to verify that the offeror is registered in the CCR database.

(3) Lack of registration in the CCR database will make an offeror ineligible for award.

(4) DoD has established a goal of registering an applicant in the CCR database within 48 hours after receipt of a complete and accurate application via the Internet. However, registration of an applicant submitting an application through a method other than the Internet may take up to 30 days. Therefore, offerors that are not registered should consider applying for registration immediately upon receipt of this solicitation.

(c) The Contractor is responsible for the accuracy and completeness of the data within the CCR, and for any liability resulting from the Government's reliance on inaccurate or incomplete data. To remain registered in the CCR database after the initial registration, the Contractor is required to confirm on an annual basis that its information in the CCR database is accurate and complete.

(d) Offerors and contractors may obtain information on registration and annual confirmation requirements by calling 1-888-227-2423, or via the Internet at <http://www.ccr2000.com>.

(End of clause)





## SECTION 00110 SUBMISSION REQUIREMENTS AND INSTRUCTIONS

## 1. PROPOSALS

Proposals for the work described herein, will be received until the date and time indicated on Standard Form 1442 in Section 00010, at the following address:

U.S. Army Engineer District, Kansas City  
 760 Federal Building  
 601 East 12<sup>th</sup> Street  
 ATTN: CENWK-CT-C/Wellons  
 Kansas City, Missouri 64106-2896

## 2. PROPOSAL FORMAT

- a. The proposals (originals) shall be no more than 150 pages total all volumes, in the following format:

Proposal Document		Original	Copies
VOLUME 1, Part 1	- Past Performance	1	6
VOLUME 1, Part 2	- Corporate Experience	1	6
VOLUME 2	- Subcontracting Plan	1	1
VOLUME 3	- Price	1	3
VOLUME 4	- Construction Quick Start	1	3

The information required by paragraph: INSTRUCTIONS TO OFFERORS--COMPETITIVE ACQUISITION, subparagraph (c)(2), shall be included in Volume 1, before Part 1.

- b. Proposal Characteristics.

(1) All text must be legible and easily read. The page size of the offeror's proposal shall not exceed 8-1/2 inch by 11 inch. Diagrams, charts and tables shall conform to the paper size. All text shall be typed single-spaced. Margins (1-inch) shall be clean and clear. If fold-out charts are unavoidable and are to be utilized, all sheets shall be reproduced on 11 inch by 17 inch, and folded to 8-1/2 inch by 11 inch sheet size with title clearly visible at bottom right corner. Volume 1 shall be contained within a 3-ring binder (no heat or spiral bound volumes). Volumes 2, 3 and 4 may be in separate 3-ring binders or stapled and provided in separate envelopes.

(2) All proposals shall contain the requirements stated herein and every volume shall be identified by the volume number and name, address, and telephone number of the prime on the cover. Each volume shall also contain a Table of Contents, List of Tables, List of Figures, List of Appendices, List of Acronyms and at the bottom left side of each page the volume number shall be included. The list of acronyms should include all acronyms appearing in the volume. The offeror's name, address, signature, and telephone number shall appear on any document to be evaluated.

(3) Proposal clarity, organization (as requested in this solicitation) and cross referencing is mandatory. No material shall be incorporated by reference. General cross references or cross referencing guides will not be considered as appropriate cross references. In order for the proposal to receive an in-depth evaluation, it is necessary that the proposal be presented in a manner which will provide clarity, organization and cross referencing as required.

(4) Each evaluation factor and subfactor in Volume 1 shall be described in a separate section, appropriately tabbed in a report form. The information in all volumes shall be concise. Elaborate presentations are not necessary or desirable.

(5) The offeror shall submit Section 00010 (including Standard Form 1442) of this solicitation with his prices. Offerors may be required to provide complete cost and pricing data and certification or information other than cost or pricing data at a later date if needed to adequately evaluate price proposals.

### 3. PROPOSAL CONTENT

a. The Government may award a contract based on initial proposals received, without discussion of such proposals, to the offeror providing the best value to the government as evaluated using applicable factors. Accordingly, each initial proposal should be submitted on the most favorable terms from a price and technical standpoint that the offeror can submit to the Government. However, the Government may request additional information from offerors of proposals, which clarifies, supplements and/or changes, any proposal as submitted.

b. Each offeror's ability to perform the work set forth in this solicitation will be evaluated on the basis of his knowledge and understanding of the work, the quality provided by his total proposal and his capability and responsibility to accomplish the project. The evaluation will be based on the offeror's proposals. The proposals shall present a comprehensive, straightforward analysis of the resources and expertise required to perform the work. While knowledge of the RFP requirements is a prerequisite to preparing proposals, restatement of the RFP requirements shall be avoided. Proposals shall emphasize knowledge and understanding of work performance, not work identification.

c. The following factors and subfactors will be used to evaluate each proposal.

**FACTOR 1. Past Performance.** Past performance will be evaluated in the areas indicated in the subfactors shown. Past performance information may be obtained from other than the sources identified by the offeror, to include past performance evaluations in the Construction Contractors Appraisal Support System (CCASS).

Provide a Performance Evaluation for the ten most recent government or private contracts completed by the offeror as a prime contractor. The Past Performance Evaluation Questionnaire along with a sample transmittal letter, are located at the end of this section and must be completed by personnel for whom the offeror has performed work. These Performance Evaluations must be provided by the offeror to persons who have knowledge of this information on past performance. Once completed, these evaluations must be sent directly to the address in paragraph: PROPOSALS, above, by the persons completing these evaluations. The offeror may also e-mail the questionnaires to the references for the past/current contract. References may then electronically complete the questionnaire and e-mail it to Pamela Wellons, Contract Specialist, [Pamela.S.Wellons@nwk02.usace.army.mil](mailto:Pamela.S.Wellons@nwk02.usace.army.mil). E-mailed or mailed questionnaires must be received by the Government no later than the closing date of the RFP.

The offeror shall not review the Performance Evaluations after they have been completed, and the persons completing these evaluations shall be informed that their names will be held confidential by the Government. At no time during the evaluation process, debriefings or after award, will the names of the individuals providing reference information about an offeror's past performance be revealed to the offeror or to any other party. These evaluations shall be received by the Government no later than the date the offeror's proposal is due.

The Performance Evaluations should clearly identify the proposer's identity and the project or portion of a project being evaluated. It is helpful to give your evaluators a short synopsis of the project or portion of a project that you wish them to evaluate. It is also helpful to include an SASE or overnight delivery envelope addressed to the address found in paragraph: PROPOSALS, and inform the evaluators to forward the evaluation in a timely manner. It is the proposer's responsibility to ensure that evaluators have completed and forwarded the evaluation in a timely manner. Those Performance Evaluations not received in a timely manner will not be considered.

In addition, the offeror will provide the following information in the proposal, Volume 1, about these ten projects:

- (a) Title, location and contract number.
- (b) Dates of contract execution (start and completion).
- (c) Contracting agency.
- (d) At least two current points of contact (names, current phone and fax numbers).
- (e) SF 294s, where available. If the project was done for a non-federal organization, information normally provided on a SF 294 shall be provided in letter format.
- (f) Brief description of the circumstances surrounding the following as they apply and any corrective action taken to preclude recurrence:
  - (i) Contract termination, in whole or in part.
  - (ii) Failure to complete awarded work.
  - (iii) Liquidated damages or actual damages assessed for delay in meeting completion dates.
- (g) Brief descriptions of the project to include size and location.

The following subfactors will be evaluated by the Government:

**Quality of Product and Services .** Reviews how well the offeror has complied with contract requirements in the past and conformance with standards of good workmanship.

**Customer Satisfaction.** Reviews how satisfied prior customers and end users are with the offeror's completed work. Includes the willingness of prior customers to do business with the offeror again if given the choice.

**Timeliness of Performance.** Reviews how well the contractor has adhered to contract schedules.

**Extent of subcontracting to small businesses, small disadvantaged businesses, and women-owned businesses.**

**FACTOR 2. Corporate Experience.** Provide in detail the experience of your organization in contracts of similar type and complexity, including a list of contracts relevant to the proposed contract that your organization has completed within the last six years, or that are currently under contract and more than 50% complete. Provide the project name, a short description, the size, the owner's name and telephone number, the date of completion and the percentage of the project accomplished with your own forces. Information regarding the type and extent of work completed under the contract shall be included. For this factor, a project of similar type, size and complexity is considered to be barracks, dormitories, college dorms, hotels/motels, dining facilities, headquarters and administration buildings, complexes including the above types of structures, where building size and complexity are similar.

**FACTOR 3. Subcontracting Plan.** All items in the sample Subcontracting Plan format provided in Section 00600 must be discussed in the Subcontracting Plan submitted. Proposers must not give cursory answers or discussions to the issues that must be addressed in the Subcontracting Plan; full and complete information is required.

Small businesses are not required to submit a Subcontracting Plan nor the additional past utilization information stated above. Small businesses will NOT be penalized nor their overall evaluation impacted by the Government's evaluation of subcontracting efforts on the part of large businesses. Subcontracting will be part of the trade off process in the best value determination by the Government and may be used as a final discriminator when comparing competing large businesses.

**FACTOR 4. Price.** Offerors shall submit the Proposal Schedule, as found in Section 00010. The Proposal Schedule will be evaluated in accordance with paragraphs: BASIS FOR AWARD, EVALUATION FACTORS, and PRICE listed below.

**d. ADDITIONAL INFORMATION TO BE PROVIDED IN VOLUME 3:**

- The Offer (the SF1442) duly executed with an original signature by an official authorized to bind the company.
- Acknowledgement of all amendments to the solicitation in accordance with the instructions on the Standard Form 30 (amendment form).
- The completed Section 00600 of the solicitation (Representations and Certifications).
- For joint ventures, the information required by paragraph "Joint Ventures."

**e. INFORMATION TO BE PROVIDED FOR CONSTRUCTION QUICK START, VOLUME 4.** This information is not evaluated but is provided to facilitate the quick start procedures described elsewhere:

- Construction schedule for first 90 days of operations (25 work items or less).
- Safety plan for first 90 days of operations.
- Temporary power plan for construction site.

Upon contract award, the information provided by the successful offeror will be reviewed for sufficiency and approved to initiate operations.

To further enable the contractor to initiate construction in a timely manner, the Government will provide expedited shop drawing review for up to 15 submittals in a 21 day time frame. The 15 shop drawings MUST be directly related to the first 120 days of anticipated construction activities and must be submitted for review within 60 days of Notice to Proceed.

## JOINT VENTURES

Joint ventures shall submit the following additional documentation regarding their business entities:

- A certified copy of their Joint Venture agreement.
- A detailed statement outlining the following in terms of percentages, where appropriate.
- The relationship of the joint venture parties in terms of business ownership, capital contribution, and profit distribution or loss sharing.
- The management approach of the joint venture in terms of who will conduct, direct, supervise and control the project and have custody and control of the assets of the joint venture and perform the duties necessary to complete the work.
- The structure of the joint venture and decision-making responsibilities of the joint venture parties in terms of who will control the manner and method of performance of the work.
- The bonding responsibilities of the joint venture parties.
- Identification of the key personnel having authority to legally bind the joint venture to subcontracts and state who will provide or contract for the labor and materials for the joint venture.

- Identification of party maintaining the joint venture bank accounts for the payment of all expenses and the deposits of all receipts, keep the books and records, and pay applicable taxes for the joint venture.
- Identification of party furnishing the facilities, such as office supplies and telephone service.
- Identification of party having overall control of the joint venture.

Other sections of the proposal shall identify, where appropriate, whether key personnel are employees of the individual joint venture parties and identify the party, or hired as employees of the joint venture.

If one of the joint venture parties possesses experience and/or past performance as a Federal Government contractor or as a Corps of Engineers contractor, that experience and/or past performance will be included as the experience and/or past performance of the joint venture.

SAMPLE TRANSMITTAL LETTER  
AND  
PAST PERFORMANCE EVALUATION QUESTIONNAIRE

Date: \_\_\_\_\_

To: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

We have listed your firm as a reference for work we have performed for you as listed below. Our firm has submitted a proposal under a project advertised by the U.S. Army Corps of Engineers, Kansas City District. In accordance with Federal Acquisition Regulations (FAR), an evaluation of our firm's past performance will be completed by the Corps of Engineers. Your candid response to the attached questionnaire will assist the evaluation team in this process.

We understand that you have a busy schedule and your participation in this evaluation is greatly appreciated. Please complete the enclosed questionnaire as thoroughly as possible. Space is provided for comments. Understand that while the responses to this questionnaire may be released to the offeror, FAR 15.306 (e)(4) prohibits the release of the names of the persons providing the responses. Complete confidentiality will be maintained. Furthermore, a questionnaire has also been sent to \_\_\_\_\_ of your organization. Only one response from each office is required. If at all possible, we suggest that you individually answer this questionnaire and then coordinate your responses with that of \_\_\_\_\_, to forge a consensus on one overall response from your organization.

Please send your completed questionnaire to the following address:

U.S. Army Engineer District, Kansas City  
ATTN: CENWK-CT-C/Wellons  
760 Federal Building  
601 East 12<sup>th</sup> Street  
Kansas City, Missouri 64016-2896

The questionnaires can also be e-mailed to [Pamela.S.Wellons@nwk02.usace.army.mil](mailto:Pamela.S.Wellons@nwk02.usace.army.mil) or faxed to 816-426-5169.

If you have questions regarding the attached questionnaire, or require assistance, please contact Ms. Wellons at (816) 983-3802. Thank you for your assistance.

Upon completion of this form, please send directly to the U.S. Army Corps of Engineers in the enclosed addressed envelope or fax to 816-426-5169, ATTN: Pamela Wellons. Do not return this form to our offices. Thank you.

- QUALITY OF PRODUCT/SERVICE:

- |  |  |
|--|--|
| Excellent quality  |  |
| Above Average quality                                    |  |
| Average quality  |  |
| Below Average quality                                    |  |
| Unsuccessful or experienced significant quality problems |  |

Remarks: \_\_\_\_\_



11. To what extent were the contractor's reports and documentation accurate, complete and submitted in a timely manner?

Excellent quality	
Above Average quality	
Average quality	
Below Average quality	
Unsuccessful or experienced significant quality problems	

Remarks: \_\_\_\_\_

12. To what extent was the contractor able to solve contract performance problems without extensive guidance from government/owner counterparts?

Excellent	
Above Average	
Average	
Below Average	
Unsuccessful	

Remarks: \_\_\_\_\_

13. How well did the contractor manage and coordinate subcontractors, suppliers, and the labor force?

Excellent	
Above Average	
Average	
Below Average	
Unsuccessful	

Remarks: \_\_\_\_\_

**CUSTOMER SATISFACTION:**

14. To what extent were the end users satisfied with:

	Quality?	Cost?	Schedule?
Exceptionally satisfied			
Highly satisfied			
Satisfied			
Somewhat Dissatisfied			
Highly dissatisfied			

Remarks: \_\_\_\_\_

15. If given the opportunity, would you work with this contractor again?

Yes \_\_\_\_\_ No \_\_\_\_\_ Not Sure \_\_\_\_\_

**TIMELINESS OF PERFORMANCE:**

16. To what extent did the contractor meet the task order schedules?

Completed substantially ahead of schedule	
Completed work on schedule with no time delays	
Completed work on schedule, with minor delays under extenuating circumstances	
Experienced significant delays without justification	

Remarks: \_\_\_\_\_

**EXTENT OF SUBCONTRACTING:**

17. To what extent did the contractor meet Small Business (SB)/ Small Disadvantaged Business (SDB)/Women-Owned Small Business (WOSB) goals?

	SB	SDB	WOSB
Greatly exceeded goal			
Exceeded goal			
Met established goal			
Experience difficulty in meeting goal			
Expended little effort to achieve established goal			

Remarks: \_\_\_\_\_

18. Did the contractor partner or have a mentor/protegee relationship with SB/SDB/WOSB as part of this contract?

Yes \_\_\_\_\_ No \_\_\_\_\_

Remarks: \_\_\_\_\_

**OTHER REMARKS:**

19. Use the space below to provide other information related to the contractor's performance. This may include the contractor's selection and management of subcontractors, effectiveness of their small/small disadvantaged business subcontracting plan, flexibility in dealing with contract challenges, their overall concern for the Government's interest (if applicable), project awards received, etc.

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## SECTION 00120 PROPOSAL EVALUATION AND CONTRACT AWARD

### 1. FORMAL SOURCE SELECTION PROCESS

All offers received in response to this solicitation will be evaluated in accordance with formal source selection procedures. The principal objective of this process is to select responsible offerors to be the overall Best Value to the Government, price and other factors considered (the Best Value). The Government reserves the right to consider and evaluate information regarding past performance from sources outside the proposal. The right is reserved to accept other than the lowest price offers and to reject any or all offers. Award may be made to the superior proposals, regardless of cost or price, provided that price is determined to be reasonable. The process is designed to ensure the impartial, equitable, and comprehensive evaluation of all technically acceptable, responsible proposals received in response to this particular solicitation.

#### Source Selection Organization.

The source selection organization is established as a separate organization and management chain of command whose only purpose is to accomplish the objective above. The organization consists of a Source Selection Authority (SSA), Source Selection Advisory Council (SSAC) and a Source Selection Evaluation Board (SSEB). The SSEB is comprised of separate Technical Evaluation and Price Evaluation teams. The organization is designed to ensure active ongoing involvement of appropriate contracting, technical, logistics, legal, price analysis, small business, and other functional staff management expertise.

#### Source Selection Procedure.

The source selection procedures will begin with an initial review of proposals and continue with a technical and price evaluation conducted by the SSEB. The SSEB shall evaluate the proposals based solely on the evaluation criteria identified in paragraph: Evaluation Factors, below. The results of the SSEB evaluations will be presented to the SSAC, who will rank the proposals based on the Best Value to the Government, price and other factors considered. The SSA will also either make the final source selection decision or determine whether it is appropriate to engage in clarifications or communication prior to establishment of a competitive range, or to establish a competitive range and conduct discussions with those offerors that are included in the competitive range. The Government intends to award without discussions. All communications leading to establishment of the competitive range will be conducted in accordance with FAR Part 15.306b.

If a competitive range is established, discussions will be conducted with offerors who are included in the competitive range. After conclusion of discussions and receipt of final revised technical proposals, the SSEB will complete the evaluation and establish final ratings. Results of the final technical ratings will be presented to the SSAC. The SSAC shall then rank the proposals based on the Best Value to the Government, price and other factors considered, and present to the SSA for the final source selection decision. If appropriate, the SSA will apply the tradeoff process in the Best Value Continuum.

The proposals received in response to this RFP will be evaluated utilizing a scoring system to select the most advantageous proposal. To be considered acceptable, each offeror shall specifically address each of the evaluation factors listed below. Sufficient detail shall be provided, citing specific data as may be required, such that the proposal may be adequately evaluated. The proposal must show clearly that the offeror has an understanding of the work tasks required and has the capability and responsibility to accomplish the project.

The Government is not responsible for information overlooked during the evaluation that is not located in the appropriate proposal section. To ensure that evaluation credit is appropriately received for proposal material submitted, do not incorporate by reference documents not contained in the proposal. References to other sections of the proposal shall be by specific paragraph number (and name, if applicable), page number and section.

#### 4. BASIS FOR AWARD

The Government intends to select, without discussions, those responsible offerors whose proposals conform to the solicitation and are determined to be the Best Value to the Government in accordance with the following relationship between price and technical merit. The technical evaluation factors, when combined, are considered of equal importance to price (see paragraphs below: Relative Weight of Technical Evaluation Criteria; and Price). The closer the total evaluated technical scores of acceptable proposals are to one another, the greater will be the importance of price in making the selection determination. The closer the final price evaluations are to one another, the greater will be the importance of the total evaluated technical scores in making the selection determination.

#### 5. EVALUATION FACTORS

Evaluation factors are listed below. All factors will be evaluated on the completeness, conciseness, and relevance of information provided. These factors are listed in the order of importance described in paragraph: Relative Weight of Technical Evaluation Criteria, with price being of equal importance to all technical factors combined.

##### FACTOR 1 (Volume 1, Part 1) – Past Performance

Quality of product and service.

Customer satisfaction.

Timeliness of performance.

Extent of subcontracting with small businesses, small disadvantaged businesses and women-owned businesses.

##### FACTOR 2 (Volume 1, Part 3) – Corporate Experience

##### FACTOR 3 (Volume 2) – Subcontracting Plan

##### FACTOR 4 (Volume 3) – Price

#### 6. RELATIVE WEIGHT OF TECHNICAL EVALUATION CRITERIA

Factor 1 is the most important technical factor. Within Factor 1, subfactor a is the most important; subfactor b is slightly less important than subfactor a; subfactor c is slightly less important than subfactor b; and subfactor d is slightly less important than subfactor c.

Factor 2 is more important than factor 3. Factor 2 is somewhat less important than Factor 1.

Factor 3 is more important than factor 4. Factor 3 is slightly less important than Factor 2.

Factor 4 is the least important technical factor. It will be part of the trade off process and may be used as a final discriminator when comparing competing large businesses.

#### 7. PRICE

a. Price will be subjectively evaluated. The specific evaluation process is described below. The technical evaluation factors, when combined, are considered equal to price. The closer the total evaluated technical scores of acceptable offers are to one another, the greater will be the importance of price in making the selection determination. The closer the final price evaluations are to one another, the greater will be the importance of the total evaluated technical scores in making the selection determination.

b. The Price Proposal Schedule (Volume 3) submitted in response to this solicitation will be subjectively evaluated for reasonableness over the life of the contract. In the event, during the course of the analysis, the Price Evaluation Team has reason to question the reasonableness of a price proposal, or has reason to believe there is unbalancing in the price proposal, the PET may conduct such additional reasonable analysis as it requires in order to

complete a thorough price analysis. Because the evaluation of the price proposal will represent a portion of the total evaluation, it is possible that an offeror might not be selected because of an unbalanced or an unreasonable price proposal.

c. The evaluated price information will be reported to the SSAC. The SSAC will utilize the technical ratings and the price evaluations in preparing its overall ranking of the proposals and as to the Best Value determination for selection of successful offerors.

## 8. PAST PERFORMANCE

In the course of evaluating offerors' proposals, the Source Selection Evaluation Board may contact references submitted by the offeror. The SSEB may also check past performance information obtained from sources other than those identified by the offeror. All gathered information will be used to evaluate the offeror's overall past performance.

At no time during this process, nor during the debriefing, nor after award, will the names of the individuals providing reference information about an offeror's past performance be revealed to the offerors or to any other party.

Sheer numbers of confirmed negative comments may not give the offeror an overall rating of less than satisfactory. Negative comments in areas that are not of vital importance to the successful performance of this contract may not result in a rating of less than satisfactory. Conversely, one or only a few negative confirmed comments in areas of vital importance to the successful performance of this contract may render an overall past performance rating less than satisfactory.

During the evaluation, the following will also be taken into consideration: the age and relevance of past performance information; the offeror's overall work record; if there are any problems identified, the number, type, and severity of the problems and the effectiveness of corrective actions taken.

During the ranking process the SSA may also consider past performance information in evaluating overall risk associated with a particular proposer.

## 9. SMALL, SMALL DISADVANTAGED AND WOMEN-OWNED BUSINESS SUBCONTRACTING PLAN

The Government will evaluate the Subcontracting Plan in accordance with Appendix CC, Subcontracting Plan Evaluation Guide, of the Army Federal Acquisition Regulation Supplement (AFARS).

As stated in paragraph PROPOSAL CONTENT, FACTOR 4, small businesses are not required to submit a Subcontracting Plan nor the additional past utilization information stated above. Small businesses will NOT be penalized nor their overall evaluation impacted by the Government's evaluation of subcontracting efforts on the part of large businesses. Subcontracting will be part of the trade off process in the best value determination by the Government and may be used as a final discriminator when comparing competing large businesses.

## 10. DEBRIEFING

In accordance with FAR 15.505 Preaward Debriefing of Offerors, and FAR 15.506 Postaward Debriefing of Offerors, the offeror should be aware of the following.

### PREAWARD DEBRIEFING OF OFFERORS (FAR 15.505)

Offerors excluded from the competitive range or otherwise excluded from the competition before award may request a debriefing before award (10 U.S.C. 2305(b)(6)(A) and 41 U.S.C. 253b(f)-(h)).

(a)(1) The offeror may request a preaward debriefing by submitting a written request for debriefing to the Contracting Officer within 3 days after receipt of the notice of exclusion from the competition.

(2) At the offeror's request, this debriefing may be delayed until after award. If the debriefing is delayed until after award, it shall include all information normally provided in a postaward debriefing (see 15.506(d)). Debriefings delayed pursuant to this paragraph could affect the timeliness of any protest filed subsequent to the debriefing.

(3) If the offeror does not submit a timely request, the offeror need not be given either a preaward or a postaward debriefing. Offerors are entitled to no more than one debriefing for each proposal.

(b) The Contracting Officer shall make every effort to debrief the unsuccessful offeror as soon as practicable, but may refuse the request for a debriefing if, for compelling reasons, it is not in the best interests of the Government to conduct a debriefing at that time. The rationale for delaying the debriefing shall be documented in the contract file. If the Contracting Officer delays the debriefing, it shall be provided no later than the time postaward debriefings are provided under 15.506. In that event, the Contracting Officer shall include the information at 15.506(d) in the debriefing.

(c) Debriefings may be done orally, in writing, or by any other method acceptable to the Contracting Officer.

The Contracting Officer should normally chair any debriefing session held. Individuals who conducted the evaluations shall provide support.

At minimum, preaward debriefings shall include--

- (1) The agency's evaluation of significant elements in the offeror's proposal;
- (2) A summary of the rationale for eliminating the offeror from the competition; and
- (3) Reasonable responses to relevant questions about whether source selection procedures contained in the solicitation, applicable regulations, and other applicable authorities were followed in the process of eliminating the offeror from the competition.

Preaward debriefings shall not disclose--

The number of offerors;

The identity of other offerors;

The content of other offerors' proposals;

The ranking of other offerors;

The evaluation of other offerors; or

Any of the information prohibited in 15.506(e).

An official summary of the debriefing shall be included in the contract file.

#### POSTAWARD DEBRIEFING OF OFFERORS FAR 15.506

(a)(1) An offeror, upon its written request received by the agency within 3 days after the date on which that offeror has received notification of contract award in accordance with 15.503(b), shall be debriefed and furnished the basis for the selection decision and contract award.

(2) To the maximum extent practicable, the debriefing should occur within 5 days after receipt of the written request. Offerors that requested a postaward debriefing in lieu of a preaward debriefing, or whose debriefing was delayed for compelling reasons beyond contract award, also should be debriefed within this time period.

(3) An offeror that was notified of exclusion from the competition (see 15.505(a)), but failed to submit a timely request, is not entitled to a debriefing.

(4)(i) Untimely debriefing requests may be accommodated.

(ii) Government accommodation of a request for delayed debriefing pursuant to 15.505(a)(2), or any untimely debriefing request, does not automatically extend the deadlines for filing protests. Debriefings delayed pursuant to 15.505(a)(2) could affect the timeliness of any protest filed subsequent to the debriefing.

(b) Debriefings of successful and unsuccessful offerors may be done orally, in writing, or by any other method acceptable to the Contracting Officer.

(c) The Contracting Officer should normally chair any debriefing session held. (Individuals who conducted the evaluations shall provide support.)

At a minimum, the debriefing information shall include--

- (1) The Government's evaluation of the significant weaknesses or deficiencies in the offeror's proposal, if applicable;
  - (2) The overall evaluated price (including unit prices), and technical rating, if applicable, of the successful offeror and the debriefed offeror, and past performance information on the debriefed offeror;
  - (3) The overall ranking of all offerors, when any ranking was developed by the agency during the source selection;
  - (4) A summary of the rationale for award;
  - (5) For acquisitions of commercial items, the make and model of the item to be delivered by the successful offeror; and
  - (6) Reasonable responses to relevant questions about whether source selection procedures contained in the solicitation, applicable regulations, and other applicable authorities were followed.
- (e) The debriefing shall not include point-by-point comparisons of the debriefed offeror's proposal with those of other offerors. Moreover, the debriefing shall not reveal any information prohibited from disclosure by 24.202 or exempt from release under the Freedom of Information Act (5 U.S.C. 552) including--

- (1) Trade secrets;

Privileged or confidential manufacturing processes and techniques;

- (3) Commercial and financial information that is privileged or confidential, including cost breakdowns, profit, indirect cost rates, and similar information; and
  - (4) The names of individuals providing reference information about an offeror's past performance.
- (f) An official summary of the debriefing shall be included in the contract file.



## SECTION 00600 Representations &amp; Certifications

## CLAUSES INCORPORATED BY FULL TEXT

## 52.203-2 CERTIFICATE OF INDEPENDENT PRICE DETERMINATION (APR 1985)

(a) The offeror certifies that --

(1) The prices in this offer have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other offeror or competitor relating to (i) those prices, (ii) the intention to submit an offer, or (iii) the methods of factors used to calculate the prices offered:

(2) The prices in this offer have not been and will not be knowingly disclosed by the offeror, directly or indirectly, to any other offeror or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a negotiated solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the offeror to induce any other concern to submit or not to submit an offer for the purpose of restricting competition.

(b) Each signature on the offer is considered to be a certification by the signatory that the signatory --

(1) Is the person in the offeror's organization responsible for determining the prices offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contradictory to subparagraphs (a)(1) through (a)(3) above; or

(2) (i) Has been authorized, in writing, to act as an agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) above \_\_\_\_\_ (insert full name of person(s) in the offeror's organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the offeror's organization);

(ii) As an authorized agent, does certify that the principals named in subdivision (b)(2)(i) above have not participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above; and

(iii) As an agent, has not personally participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above.

(c) If the offeror deletes or modifies subparagraph (a)(2) above, the offeror must furnish with its offer a signed statement setting forth in detail the circumstances of the disclosure.

(End of clause)

## 52.203-11 CERTIFICATION AND DISCLOSURE REGARDING PAYMENTS TO INFLUENCE CERTAIN FEDERAL TRANSACTIONS (APR 1991)

(a) The definitions and prohibitions contained in the clause, at FAR 52.203-12, Limitation on Payments to Influence Certain Federal Transactions, included in this solicitation, are hereby incorporated by reference in paragraph (b) of this Certification.

(b) The offeror, by signing its offer, hereby certifies to the best of his or her knowledge and belief that on or after December 23, 1989, --

(1) No Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a member of Congress on his or her behalf in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment or modification of any Federal contract, grant, loan, or cooperative agreement;

(2) If any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress or an employee of a Member of Congress on his or her behalf in connection with this solicitation, the offeror shall complete and submit, with its offer, OMB standard form LLL, Disclosure of Lobbying Activities, to the Contracting Officer; and

(3) He or she will include the language of this certification in all subcontract awards at any tier and require that all recipients of subcontract awards in excess of \$100,000 shall certify and disclose accordingly.

(c) Submission of this certification and disclosure is a prerequisite for making or entering into this contract imposed by section 1352, title 31, United States Code. Any person who makes an expenditure prohibited under this provision, shall be subject to a civil penalty of not less than \$10,000, and not more than \$100,000, for each such failure.

(End of provision)

#### 52.204-3 TAXPAYER IDENTIFICATION (OCT 1998)

##### (a) Definitions.

Common parent, as used in this provision, means that corporate entity that owns or controls an affiliated group of corporations that files its Federal income tax returns on a consolidated basis, and of which the offeror is a member.

Taxpayer Identification Number (TIN), as used in this provision, means the number required by the Internal Revenue Service (IRS) to be used by the offeror in reporting income tax and other returns. The TIN may be either a Social Security Number or an Employer Identification Number.

(b) All offerors must submit the information required in paragraphs (d) through (f) of this provision to comply with debt collection requirements of 31 U.S.C. 7701(c) and 3325(d), reporting requirements of 26 U.S.C. 6041, 6041A, and 6050M, and implementing regulations issued by the IRS. If the resulting contract is subject to the payment reporting requirements described in Federal Acquisition Regulation (FAR) 4.904, the failure or refusal by the offeror to furnish the information may result in a 31 percent reduction of payments otherwise due under the contract.

(c) The TIN may be used by the Government to collect and report on any delinquent amounts arising out of the offeror's relationship with the Government (31 U.S.C. 7701(c)(3)). If the resulting contract is subject to the payment reporting requirements described in FAR 4.904, the TIN provided hereunder may be matched with IRS records to verify the accuracy of the offeror's TIN.

##### (d) Taxpayer Identification Number (TIN).

\_\_\_ TIN:-----

\_\_\_ TIN has been applied for.

\_\_\_ TIN is not required because:

\_\_\_ Offeror is a nonresident alien, foreign corporation, or foreign partnership that does not have income effectively connected with the conduct of a trade or business in the United States and does not have an office or place of business or a fiscal paying agent in the United States;

\_\_\_ Offeror is an agency or instrumentality of a foreign government;

\_\_\_ Offeror is an agency or instrumentality of the Federal Government.

(e) Type of organization.

\_\_\_ Sole proprietorship;

\_\_\_ Partnership;

\_\_\_ Corporate entity (not tax-exempt);

\_\_\_ Corporate entity (tax-exempt);

\_\_\_ Government entity (Federal, State, or local);

\_\_\_ Foreign government;

\_\_\_ International organization per 26 CFR 1.6049-4;

\_\_\_ Other-----

(f) Common parent.

\_\_\_ Offeror is not owned or controlled by a common parent as defined in paragraph (a) of this provision.

\_\_\_ Name and TIN of common parent:

Name-----

TIN-----

(End of provision)

#### 52.204-5 WOMEN-OWNED BUSINESS (OTHER THAN SMALL BUSINESS) (MAY 1999)

(a) Definition. Women-owned business concern, as used in this provision, means a concern that is at least 51 percent owned by one or more women; or in the case of any publicly owned business, at least 51 percent of its stock is owned by one or more women; and whose management and daily business operations are controlled by one or more women.

(b) Representation. [Complete only if the offeror is a women-owned business concern and has not represented itself as a small business concern in paragraph (b)(1) of FAR 52.219-1, Small Business Program Representations, of this solicitation.] The offeror represents that it ( ) is a women-owned business concern.

(End of provision)

#### 52.209-5 CERTIFICATION REGARDING DEBARMENT, SUSPENSION, PROPOSED DEBARMENT, AND OTHER RESPONSIBILITY MATTERS (APR 2001)

(a)(1) The Offeror certifies, to the best of its knowledge and belief, that--

(i) The Offeror and/or any of its Principals --

(A) Are ( ) are not ( ) presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency;

(B) Have ( ) have not ( ), within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(C) Are ( ) are not ( ) presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in subdivision (a)(1)(i)(D) of this provision.

(ii) The Offeror has ( ) has not ( ), within a three-year period preceding this offer, had one or more contracts terminated for default by any Federal agency.

(D) Have ( ) have not ( ), within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, state, or local) contract or subcontract; violation of Federal or state antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, tax evasion, or receiving stolen property; and

(E) Are ( ) are not ( ) presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in subdivision (a)(1)(i)(B) of this provision.

(2) "Principals," for the purposes of this certification, means officers; directors; owners; partners; and, persons having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a subsidiary, division, or business segment, and similar positions).

THIS CERTIFICATION CONCERNS A MATTER WITHIN THE JURISDICTION OF AN AGENCY OF THE UNITED STATES AND THE MAKING OF A FALSE, FICTITIOUS, OR FRAUDULENT CERTIFICATION MAY RENDER THE MAKER SUBJECT TO PROSECUTION UNDER SECTION 1001, TITLE 18, UNITED STATES CODE.

(b) The Offeror shall provide immediate written notice to the Contracting Officer if, at any time prior to contract award, the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(c) A certification that any of the items in paragraph (a) of this provision exists will not necessarily result in withholding of an award under this solicitation. However, the certification will be considered in connection with a determination of the Offeror's responsibility. Failure of the Offeror to furnish a certification or provide such additional information as requested by the Contracting Officer may render the Offeror nonresponsible.

(d) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(e) The certification in paragraph (a) of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Offeror knowingly rendered an erroneous certification, in addition to other remedies available to the Government, the Contracting Officer may terminate the contract resulting from this solicitation for default.

(End of provision)

52.215-6 PLACE OF PERFORMANCE (OCT 1997)

(a) The offeror or respondent, in the performance of any contract resulting from this solicitation, ( ) intends, ( ) does not intend [check applicable block] to use one or more plants or facilities located at a different address from the address of the offeror or respondent as indicated in this proposal or response to request for information.

(b) If the offeror or respondent checks “intends” in paragraph (a) of this provision, it shall insert in the following spaces the required information:

-----  
 Place of performance (street      Name and address of owner and  
 address, city, state, county, zip      operator of the plant or facility  
    code)      if other than offeror or respondent  
 -----

\_\_\_\_\_.  
 \_\_\_\_\_  
 -----

52.219-1 SMALL BUSINESS PROGRAM REPRESENTATIONS (OCT 2000) ALTERNATE I (OCT 2000) & ALTERNATE II (OCT 2000)

(a)(1) The North American Industry Classification System (NAICS) code for this acquisition is 233320.

(2) The small business size standard is \$27,500,000.

(3) The small business size standard for a concern which submits an offer in its own name, other than on a construction or service contract, but which proposes to furnish a product which it did not itself manufacture, is 500 employees.

(b) Representations. (1) The offeror represents as part of its offer that it ( ) is, ( ) is not a small business concern.

(2) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents, for general statistical purposes, that it ( ) is, ( ) is not a small disadvantaged business concern as defined in 13 CFR 124.1002.

(3) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it ( ) is, ( ) is not a women-owned small business concern.

(4) (Complete only if the offeror represented itself as a small business concern in paragraph (b)(1) of this provision.) The offeror represents as part of its offer that it ( ) is, ( ) is not a veteran-owned small business concern.

(5) (Complete only if the offeror represented itself as a veteran-owned small business concern in paragraph (b)(4) of this provision.) The offeror represents as part of its offer that it ( ) is, ( ) is not a service-disabled veteran-owned small business concern.

(6) (Complete only if offeror represented itself as small business concern in paragraph (b)(1) of this provision). The offeror represents, as part of its offer, that--

(i) It ( ) is, ( ) is not a HUBZone small business concern listed, on the date of this representation, on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration, and no material

change in ownership and control, principal office, or HUBZone employee percentage has occurred since it was certified by the Small Business Administration in accordance with 13 CFR Part 126; and

(ii) It ( ) is, ( ) is not a joint venture that complies with the requirements of 13 CFR Part 126, and the representation in paragraph (b)(6)(i) of this provision is accurate for the HUBZone small business concern or concerns that are participating in the joint venture. (The offeror shall enter the name or names of the HUBZone small business concern or concerns that are participating in the joint venture: \_\_\_\_\_.) Each HUBZone small business concern participating in the joint venture shall submit a separate signed copy of the HUBZone representation.

(7) (Complete if offeror represented itself as disadvantaged in paragraph (b)(2) of this provision.) The offeror shall check the category in which its ownership falls:

( ) Black American.

( ) Hispanic American.

( ) Native American (American Indians, Eskimos, Aleuts, or Native Hawaiians).

( ) Asian-Pacific American (persons with origins from Burma, Thailand, Malaysia, Indonesia, Singapore, Brunei, Japan, China, Taiwan, Laos, Cambodia (Kampuchea), Vietnam, Korea, The Philippines, U.S. Trust Territory of the Pacific Islands (Republic of Palau), Republic of the Marshall Islands, Federated States of Micronesia, the Commonwealth of the Northern Mariana Islands, Guam, Samoa, Macao, Hong Kong, Fiji, Tonga, Kiribati, Tuvalu, or Nauru).

( ) Subcontinent Asian (Asian-Indian) American (persons with origins from India, Pakistan, Bangladesh, Sri Lanka, Bhutan, the Maldives Islands, or Nepal).

(c) Definitions. As used in this provision--

Service-disabled veteran-owned small business concern --

(1) Means a small business concern--

(i) Not less than 51 percent of which is owned by one or more service-disabled veterans or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more service-disabled veterans; and

(ii) The management and daily business operations of which are controlled by one or more service-disabled veterans or, in the case of a veteran with permanent and severe disability, the spouse or permanent caregiver of such veteran.

(2) Service-disabled veteran means a veteran, as defined in 38 U.S.C. 101(2), with a disability that is service-connected, as defined in 38 U.S.C. 101(16).

"Small business concern," means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding on Government contracts, and qualified as a small business under the criteria in 13 CFR Part 121 and the size standard in paragraph (a) of this provision.

Veteran-owned small business concern means a small business concern --

(1) Not less than 51 percent of which is owned by one or more veterans (as defined at 38 U.S.C. 101(2)) or, in the case of any publicly owned business, not less than 51 percent of the stock of which is owned by one or more veterans; and

(2) The management and daily business operations of which are controlled by one or more veterans.

"Women-owned small business concern," means a small business concern --

(1) Which is at least 51 percent owned by one or more women or, in the case of any publicly owned business, at least 51 percent of the stock of which is owned by one or more women; and

(2) Whose management and daily business operations are controlled by one or more women.

(d) Notice.

(1) If this solicitation is for supplies and has been set aside, in whole or in part, for small business concerns, then the clause in this solicitation providing notice of the set-aside contains restrictions on the source of the end items to be furnished.

(2) Under 15 U.S.C. 645(d), any person who misrepresents a firm's status as a small, HUBZone small, small disadvantaged, or women-owned small business concern in order to obtain a contract to be awarded under the preference programs established pursuant to section 8(a), 8(d), 9, or 15 of the Small Business Act or any other provision of Federal law that specifically references section 8(d) for a definition of program eligibility, shall--

(i) Be punished by imposition of fine, imprisonment, or both;

(ii) Be subject to administrative remedies, including suspension and debarment; and

(iii) Be ineligible for participation in programs conducted under the authority of the Act.

(End of provision)

#### 52.219-21 SMALL BUSINESS SIZE REPRESENTATION FOR TARGETED INDUSTRY CATEGORIES UNDER THE SMALL BUSINESS COMPETITIVENESS DEMONSTRATION PROGRAM (MAY 1999)

(Complete only if the Offeror has represented itself under the provision at 52.219-1 as a small business concern under the size standards of this solicitation.)

Offeror's number of employees for the past 12 months (check this column if size standard stated in solicitation is expressed in terms of number of employees) or Offeror's average annual gross revenue for the last 3 fiscal years (check this column if size standard stated in solicitation is expressed in terms of annual receipts). (Check one of the following.)

No. of Employees    Avg. Annual Gross Revenues

\_\_\_ 50 or fewer    \_\_\_ \$1 million or less

\_\_\_ 51 - 100    \_\_\_ \$1,000,001 - \$2 million

\_\_\_ 101 - 250    \_\_\_ \$2,000,001 - \$3.5 million

\_\_\_ 251 - 500    \_\_\_ \$3,500,001 - \$5 million

\_\_\_ 501 - 750    \_\_\_ \$5,000,001 - \$10 million

\_\_\_ 751 - 1,000    \_\_\_ \$10,000,001 - \$17 million

\_\_\_ 17 million

(End of provision)

## 52.222-21 PROHIBITION OF SEGREGATED FACILITIES (FEB 1999)

(a) Segregated facilities, as used in this clause, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees, that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, sex, or national origin because of written or oral policies or employee custom. The term does not include separate or single-user rest rooms or necessary dressing or sleeping areas provided to assure privacy between the sexes.

(b) The Contractor agrees that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The Contractor agrees that a breach of this clause is a violation of the Equal Opportunity clause in this contract.

(c) The Contractor shall include this clause in every subcontract and purchase order that is subject to the Equal Opportunity clause of this contract.

(End of clause)

## 52.222-22 PREVIOUS CONTRACTS AND COMPLIANCE REPORTS (FEB 1999)

The offeror represents that --

(a) ☐ It has, ☐ has not participated in a previous contract or subcontract subject to the Equal Opportunity clause of this solicitation;

(b) ☐ It has, ☐ has not, filed all required compliance reports; and

(c) Representations indicating submission of required compliance reports, signed by proposed subcontractors, will be obtained before subcontract awards.

(End of provision)

## 52.223-4 RECOVERED MATERIAL CERTIFICATION (OCT 1997)

As required by the Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6962(c)(3)(A)(i)), the offeror certifies, by signing this offer, that the percentage of recovered materials to be used in the performance of the contract will be at least the amount required by the applicable contract specifications.

## 52.223-13 CERTIFICATION OF TOXIC CHEMICAL RELEASE REPORTING (OCT 2000)

(a) Submission of this certification is a prerequisite for making or entering into this contract imposed by Executive Order 12969, August 8, 1995.

(b) By signing this offer, the offeror certifies that--

(1) As the owner or operator of facilities that will be used in the performance of this contract that are subject to the filing and reporting requirements described in section 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) (42 U.S.C. 11023) and section 6607 of the Pollution Prevention Act of 1990 (PPA) (42 U.S.C. 13106), the offeror will file and continue to file for such facilities for the life of the contract the Toxic Chemical Release Inventory Form (Form R) as described in sections 313(a) and (g) of EPCRA and section 6607 of PPA; or



(2) None of its owned or operated facilities to be used in the performance of this contract is subject to the Form R filing and reporting requirements because each such facility is exempt for at least one of the following reasons: (Check each block that is applicable.)

☐ (i) The facility does not manufacture, process or otherwise use any toxic chemicals listed under section 313(c) of EPCRA, 42 U.S.C. 11023(c);

☐ (ii) The facility does not have 10 or more full-time employees as specified in section 313.(b)(1)(A) of EPCRA 42 U.S.C. 11023(b)(1)(A);

☐ (iii) The facility does not meet the reporting thresholds of toxic chemicals established under section 313(f) of EPCRA, 42 U.S.C. 11023(f) (including the alternate thresholds at 40 CFR 372.27, provided an appropriate certification form has been filed with EPA);

☐ (iv) The facility does not fall within Standard Industrial Classification Code (SIC) major groups 20 through 39 or their corresponding North American Industry Classification System (NAICS) sectors 31 through 33; or

☐ (v) The facility is not located within any State of the United States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the United States Virgin Islands, the Northern Mariana Islands, or any other territory or possession over which the United States has jurisdiction.

#### 52.226-2 HISTORICALLY BLACK COLLEGE OR UNIVERSITY AND MINORITY INSTITUTION REPRESENTATION (MAY 2001)

(a) Definitions. As used in this provision--

Historically black college or university means an institution determined by the Secretary of Education to meet the requirements of 34 CFR 608.2. For the Department of Defense, the National Aeronautics and Space Administration, and the Coast Guard, the term also includes any nonprofit research institution that was an integral part of such a college or university before November 14, 1986.

Minority institution means an institution of higher education meeting the requirements of Section 1046(3) of the Higher Education Act of 1965 (20 U.S.C. 1067k, including a Hispanic-serving institution of higher education, as defined in Section 316(b)(1) of the Act (20 U.S.C. 1101a)).

(b) Representation. The offeror represents that it--

☐ is ☐ is not a historically black college or university;

☐ is ☐ is not a minority institution.

(End of provision)

#### 52.230-1 COST ACCOUNTING STANDARDS NOTICES AND CERTIFICATION (JUN 2000)

Note: This notice does not apply to small businesses or foreign governments. This notice is in three parts, identified by Roman numerals I through III.

Offerors shall examine each part and provide the requested information in order to determine Cost Accounting Standards (CAS) requirements applicable to any resultant contract.

If the offeror is an educational institution, Part II does not apply unless the contemplated contract will be subject to full or modified CAS coverage pursuant to 48 CFR 9903.201-2(c)(5) or 9903.201-2(c)(6), respectively.

#### I. DISCLOSURE STATEMENT--COST ACCOUNTING PRACTICES AND CERTIFICATION

(a) Any contract in excess of \$500,000 resulting from this solicitation will be subject to the requirements of the Cost Accounting Standards Board (48 CFR Chapter 99), except for those contracts which are exempt as specified in 48 CFR 9903.201-1.

(b) Any offeror submitting a proposal which, if accepted, will result in a contract subject to the requirements of 48 CFR Chapter 99 must, as a condition of contracting, submit a Disclosure Statement as required by 48 CFR 9903.202. When required, the Disclosure Statement must be submitted as a part of the offeror's proposal under this solicitation unless the offeror has already submitted a Disclosure Statement disclosing the practices used in connection with the pricing of this proposal. If an applicable Disclosure Statement has already been submitted, the offeror may satisfy the requirement for submission by providing the information requested in paragraph (c) of Part I of this provision.

**CAUTION:** In the absence of specific regulations or agreement, a practice disclosed in a Disclosure Statement shall not, by virtue of such disclosure, be deemed to be a proper, approved, or agreed-to practice for pricing proposals or accumulating and reporting contract performance cost data.

(c) Check the appropriate box below:

(1) Certificate of Concurrent Submission of Disclosure Statement.

The offeror hereby certifies that, as a part of the offer, copies of the Disclosure Statement have been submitted as follows: (i) original and one copy to the cognizant Administrative Contracting Officer (ACO) or cognizant Federal agency official authorized to act in that capacity (Federal official), as applicable, and (ii) one copy to the cognizant Federal auditor.

(Disclosure must be on Form No. CASB DS-1 or CASB DS-2, as applicable. Forms may be obtained from the cognizant ACO or Federal official and/or from the loose-leaf version of the Federal Acquisition Regulation.)

Date of Disclosure Statement: \_\_\_\_\_ Name and Address of Cognizant ACO or Federal Official Where Filed: \_\_\_\_\_

The offeror further certifies that the practices used in estimating costs in pricing this proposal are consistent with the cost accounting practices disclosed in the Disclosure Statement.

(2) Certificate of Previously Submitted Disclosure Statement.

The offeror hereby certifies that the required Disclosure Statement was filed as follows:

Date of Disclosure Statement: \_\_\_\_\_ Name and Address of Cognizant ACO or Federal Official Where Filed: \_\_\_\_\_

The offeror further certifies that the practices used in estimating costs in pricing this proposal are consistent with the cost accounting practices disclosed in the applicable Disclosure Statement.

(3) Certificate of Monetary Exemption.

The offeror hereby certifies that the offeror, together with all divisions, subsidiaries, and affiliates under common control, did not receive net awards of negotiated prime contracts and subcontracts subject to CAS totaling more than \$50 million (of which at least one award exceeded \$1 million) in the cost accounting period immediately preceding the period in which this proposal was submitted. The offeror further certifies that if such status changes before an award resulting from this proposal, the offeror will advise the Contracting Officer immediately.

(4) Certificate of Interim Exemption.

The offeror hereby certifies that (i) the offeror first exceeded the monetary exemption for disclosure, as defined in (3) of this subsection, in the cost accounting period immediately preceding the period in which this offer was submitted and (ii) in accordance with 48 CFR 9903.202-1, the offeror is not yet required to submit a Disclosure Statement. The offeror further certifies that if an award resulting from this proposal has not been made within 90 days after the end of that period, the offeror will immediately submit a revised certificate to the Contracting Officer, in the form specified under subparagraph (c)(1) or (c)(2) of Part I of this provision, as appropriate, to verify submission of a completed Disclosure Statement.

CAUTION: Offerors currently required to disclose because they were awarded a CAS-covered prime contract or subcontract of \$50 million or more in the current cost accounting period may not claim this exemption (4). Further, the exemption applies only in connection with proposals submitted before expiration of the 90-day period following the cost accounting period in which the monetary exemption was exceeded.

## II. COST ACCOUNTING STANDARDS--ELIGIBILITY FOR MODIFIED CONTRACT COVERAGE

If the offeror is eligible to use the modified provisions of 48 CFR 9903.201-2(b) and elects to do so, the offeror shall indicate by checking the box below. Checking the box below shall mean that the resultant contract is subject to the Disclosure and Consistency of Cost Accounting Practices clause in lieu of the Cost Accounting Standards clause.

☐ The offeror hereby claims an exemption from the Cost Accounting Standards clause under the provisions of 48 CFR 9903.201-2(b) and certifies that the offeror is eligible for use of the Disclosure and Consistency of Cost Accounting Practices clause because during the cost accounting period immediately preceding the period in which this proposal was submitted, the offeror received less than \$50 million in awards of CAS-covered prime contracts and subcontracts. The offeror further certifies that if such status changes before an award resulting from this proposal, the offeror will advise the Contracting Officer immediately.

CAUTION: An offeror may not claim the above eligibility for modified contract coverage if this proposal is expected to result in the award of a CAS-covered contract of \$50 million or more or if, during its current cost accounting period, the offeror has been awarded a single CAS-covered prime contract or subcontract of \$25 million or more.

## III. ADDITIONAL COST ACCOUNTING STANDARDS APPLICABLE TO EXISTING CONTRACTS

The offeror shall indicate below whether award of the contemplated contract would, in accordance with subparagraph (a)(3) of the Cost Accounting Standards clause, require a change in established cost accounting practices affecting existing contracts and subcontracts.

☐ YES ☐ NO

(d) The Contractor shall include in all negotiated subcontracts which the Contractor enters into, the substance of this clause, except paragraph (b), and shall require such inclusion in all other subcontracts, of any tier, including the obligation to comply with all CAS in effect on the subcontractor's award date or if the subcontractor has submitted cost or pricing data, on the date of final agreement on price as shown on the subcontractor's signed Certificate of Current Cost or Pricing Data. If the subcontract is awarded to a business unit which pursuant to 48 CFR 9903.201-3 is subject to other types of CAS coverage, the substance of the applicable clause set forth in subsection 30.201-4 of the Federal Acquisition Regulation shall be inserted. This requirement shall apply only to negotiated subcontracts in excess of \$500,000, except that the requirement shall not apply to negotiated subcontracts otherwise exempt from the requirement to include a CAS clause as specified in 48 CFR 9903.201-1.

(End of clause)

252.209-7001 DISCLOSURE OF OWNERSHIP OR CONTROL BY THE GOVERNMENT OF A TERRORIST COUNTRY (MAR 1998)

(a) "Definitions."

As used in this provision --

(a) "Government of a terrorist country" includes the state and the government of a terrorist country, as well as any political subdivision, agency, or instrumentality thereof.

(2) "Terrorist country" means a country determined by the Secretary of State, under section 6(j)(1)(A) of the Export Administration Act of 1979 (50 U.S.C. App. 2405(j)(i)(A)), to be a country the government of which has repeatedly provided support for such acts of international terrorism. As of the date of this provision, terrorist countries include: Cuba, Iran, Iraq, Libya, North Korea, Sudan, and Syria.

(3) "Significant interest" means --

(i) Ownership of or beneficial interest in 5 percent or more of the firm's or subsidiary's securities. Beneficial interest includes holding 5 percent or more of any class of the firm's securities in "nominee shares," "street names," or some other method of holding securities that does not disclose the beneficial owner;

(ii) Holding a management position in the firm, such as a director or officer;

(iii) Ability to control or influence the election, appointment, or tenure of directors or officers in the firm;

(iv) Ownership of 10 percent or more of the assets of a firm such as equipment, buildings, real estate, or other tangible assets of the firm; or

(v) Holding 50 percent or more of the indebtedness of a firm.

(b) "Prohibition on award."

In accordance with 10 U.S.C. 2327, no contract may be awarded to a firm or a subsidiary of a firm if the government of a terrorist country has a significant interest in the firm or subsidiary or, in the case of a subsidiary, the firm that owns the subsidiary, unless a waiver is granted by the Secretary of Defense.

(c) "Disclosure."

If the government of a terrorist country has a significant interest in the Offeror or a subsidiary of the Offeror, the Offeror shall disclose such interest in an attachment to its offer. If the Offeror is a subsidiary, it shall also disclose any significant interest the government of a terrorist country has in any firm that owns or controls the subsidiary. The disclosure shall include --

(1) Identification of each government holding a significant interest; and

(2) A description of the significant interest held by each government.

(End of provision)

#### 252.247-7022 REPRESENTATION OF EXTENT OF TRANSPORTATION BY SEA (AUG 1992)

(a) The Offeror shall indicate by checking the appropriate blank in paragraph (b) of this provision whether transportation of supplies by sea is anticipated under the resultant contract. The term supplies is defined in the Transportation of Supplies by Sea clause of this solicitation.

(b) Representation. The Offeror represents that it:

\_\_\_\_ (1) Does anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

\_\_\_\_ (2) Does not anticipate that supplies will be transported by sea in the performance of any contract or subcontract resulting from this solicitation.

(c) Any contract resulting from this solicitation will include the Transportation of Supplies by Sea clause. If the Offeror represents that it will not use ocean transportation, the resulting contract will also include the Defense FAR Supplement clause at 252.247-7024, Notification of Transportation of Supplies by Sea.

(End of provision)

Subcontracting Plan for subject project includes the requirements of Public Law 95-507, Public Law 101-507 Public Law 99-661, Public Law 100-180, FAR Part 19, FAR Clause 52.219-9 and Acquisition Letter 92-9.

CONTRACTOR NAME: \_\_\_\_\_

PROJECT TITLE: \_\_\_\_\_

CONTRACT NUMBER: \_\_\_\_\_

SOLICITATION NUMBER: \_\_\_\_\_

**NEGOTIATED ACQUISITION:** When a contract or contract modification, inclusive of all options, which individually is expected to exceed \$500,000 (\$1,000,000 for construction) and has subcontracting possibilities, shall require the apparently successful offeror to submit an acceptable subcontracting plan which separately identifies subcontracts with Small Business and Small Disadvantaged Businesses as required by FAR 19.7 prior to award.

**SEALED BID ACQUISITION:** When a contract or contract modification, inclusive of all options, which individually is expected to exceed \$500,000 (\$1,000,000 for construction) and has subcontracting possibilities, shall require the bidder selected for award to submit an acceptable subcontracting plan which separately identifies subcontracting with Small Business and Small Disadvantaged Businesses as required by FAR 19.7 prior to award.

SMALL BUSINESS AND SMALL DISADVANTAGED  
BUSINESS SUBCONTRACTING PLAN

DATE:

The following, together with any attachments, are hereby submitted as a Subcontracting Plan to satisfy the applicable requirements of Public Law 99-661, Public Law 100-180, Public Law 95-507, Public Law 99-661, Public Law 100-800, FAR 19.7, FAR Clause 52.219-9 and Acquisition Letter 92-9.

1. The firm of \_\_\_\_\_ has issued a Policy Statement and Evidence of Internal Guidance to Company buyers recognizing commitment to Public Law 99-661 and Public Law 100-180. This Policy Statement defines the Corporate and Management Commitment as evidenced in an individual plan and master plan by specifically referencing the Public Laws regarding Small Disadvantaged Businesses (SDB's) and Historically Black Colleges and Universities/Minority Institutions (HBCU/MI's).

2. (a) The total contract or modification amount, inclusive of all options, are \$\_\_\_\_\_.

(b) The following estimated dollar value of all planned subcontracting dollars (to all types of business concerns) under this contract are \$\_\_\_\_\_. (Leave blank if an Indefinite Delivery Type Contract)

GOALS FOR THE BASIC CONTRACT

(c) The following percentage goals are applicable to the contract cited above or to the contract awarded under the solicitation cited.

(i) Small Business concerns:

\_\_\_% of total planned subcontracting dollars under this contract will go to subcontractors who are Small Business concerns. (If an Indefinite Delivery Type Contract - this percentage will be applied to all Delivery Orders.) (U.S. Army Corps of Engineers Goal - 61.0%)

(ii) Small Disadvantaged Business (SDB) Concerns:

\_\_\_% of total subcontract dollars under this contract will go to subcontractors who are small business concerns owned and controlled by socially economically disadvantaged individuals (SDB's). (USACE and EPA SDB Goal - 8.0 Percent) (PL 101-507) This percentage is a subset of 2.(c)(i).

Per DFAR 219.704, SDB Concerns also include:

Historically Black Colleges and Universities/Minority Institutions (HBCU/MI's).

\_\_\_% of total subcontract dollars under this contract will go to subcontractors who are HBCU/MI's. This percentage is a subset of 2.(c)(ii).

Per Public Law 101-57 (EPA-Superfund Projects Only) SDB includes Small Women-Owned Business Concerns.

% of total subcontract dollars under this contract will go to Small Women-Owned businesses. This percentage is a subset of 2.(c)(ii).

(USACE & EPA SDB Goal for Superfund are - 8% of total contract dollars).

(d) The following dollar values correspond to the percentage goals shown in (c) above.

(i) Total dollars planned to be subcontracted to small business concerns: \$\_\_\_\_\_ (Leave Blank if an Indefinite Delivery Contract).

(ii) Total dollars intended to be subcontracted to small disadvantaged business concerns: \$\_\_\_\_\_. This dollar amount is included in the amount shown under 2.(c)(i), above, as a subset. (Leave Blank if an Indefinite Delivery Contract).

Total dollars intended to be subcontracted to HBCU/MI's: \$\_\_\_\_\_. This dollar amount is included in the amount shown under 2.(c)(ii), above, as a subset. (Leave Blank if an Indefinite Delivery Contract).

Total dollars intended to be subcontracted to Small Women-Owned Businesses: \$\_\_\_\_\_. For EPA Superfund this dollar amount is included in the amount shown under 2.(c)(ii), above, as a subset. (Leave Blank if an Indefinite Delivery Contract).

#### GOALS FOR OPTIONS (when applicable)

Separate goals are established for each option.

The following must be completed for each Option:

Option Description: \_\_\_\_\_

The following percentage goals are applicable to the option referenced above.

(i) Small Business concerns:

\_\_\_% of total planned subcontracting dollars under this option will go to subcontractors who are Small Business concerns. (U.S. Army Corps of Engineers Goal - 61.0%)

(ii) Small Disadvantaged Business (SDB) Concerns:

\_\_\_% of total subcontract dollars for this Option will go to subcontractors who are small business concerns owned and controlled by socially economically disadvantaged individuals (SDB's). (USACE and EPA SDB Goal - 8.0 Percent) (PL 101-507) This percentage is a subset of 2.(c)(i).

Per DFAR 219.704, SDB Concerns also include:

Historically Black Colleges and Universities/Minority Institutions (HBCU/MI's).

\_\_\_% of total subcontract dollars under this option will go to subcontractors who are HBCU/MI's. This percentage is a subset of 2.(c)(ii).

Per Public Law 101-57 (EPA-Superfund Projects Only) SDB include Small Women-Owned Business Concerns.

\_\_\_% of total subcontract dollars under this option will go to Small Women-Owned Businesses. This percentage is a subset of 2.(c)(ii). (USACE & EPA SDB Goal for Superfund are - 8% of total dollars).

#### OPTIONS

The following dollar values correspond to the percentage goals shown above.

(i) Total dollars planned to be subcontracted to small business concerns: \$\_\_\_\_\_. (Leave Blank if an Indefinite Delivery Contract).

(ii) Total dollars intended to be subcontracted to small disadvantaged business concerns: \$\_\_\_\_\_. This dollar amount is included in the amount shown under 2.(c)(i), above, as a subset. (Leave Blank if an Indefinite Delivery Contract).

Total dollars intended to be subcontracted to HBCU/MI's: \$\_\_\_\_\_. This dollar amount is included in the amount shown under 2.(c)(ii), above, as a subset. (Leave Blank if an Indefinite Delivery Contract).

Total dollars intended to be subcontracted to Small Women-Owned Businesses: \$\_\_\_\_\_. For EPA Superfund this dollar amount is included in the amount shown under 2.(c)(ii), above, as a subset. (Leave Blank if an Indefinite Delivery Contract).



(e) The following principal supplies and/or services along with the firm name for the Small Business or Small Disadvantaged Business Concern (if known) for traditional and non-traditional areas will be subcontracted under this contract, and distributed among small and small disadvantaged business concerns (FAR 52.219-9(d)(3)) is as follows:

Note:   \* To be subcontracted to small business concerns.  
          \*\* To be subcontracted to small disadvantaged business concerns.  
          \*\*\* To be subcontracted to HBCU/MI's.  
          \*\*\*\* To be subcontracted to Small & Women-Owned business concerns.

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(f) A description of supplies and services to be subcontracted and planned for subcontracting to Small and Small Disadvantaged Businesses are as follows:

(i) Discussion of proposal preparation with the Small and SDB firms and/or extent to which subcontracting to these firms may reasonably be assured will be accomplished by:

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(ii) Generic listing of routine supplies and services included in the materials listing for this contract

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(iii) Projects will be reviewed for possible breakout of work effort for SDB acquisitions. (FAR 52.219(e)(1)/(2))

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(iv) Specific areas will be targeted, when appropriate, for technical review and identify specific areas for consideration for breakout for SDB competition. Efforts will be made to work with large business subcontractors to insure flowdown.

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(g) The following method was used in developing subcontract goals (i.e. statement explaining how the product and service areas to be subcontracted were established, how the areas to be subcontracted to small and small disadvantaged business concerns were determined and how small and small disadvantaged business concerns' capabilities were determined, to include identification of sources used in making those determinations.) Goals will be sought that are realistic in view of actions stated to be taken in other portions of the plan and make or buy plan, if applicable. The goal as established is reasonable in comparison with past experience, yet indicates reasonable effort to improve on past experience in terms of dollars, number of SDBs involved, and movement into areas without previous SDB involvement. SDBs will be given every opportunity to perform on large projects as a subcontractor. Forecasts for improvement will be sought toward subcontracting efforts to Small and SDBs.

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(h) Efforts to increase awards to small and small disadvantaged business for non-complex and general housekeeping supplies or services has been accomplished by:

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(i) Efforts to increase the number of SDB sources awarded subcontracts and establishing plans to use SDB set-asides and the extent of our intention to use SDB set-asides (DFAR 219.705.4(a)(3)) is as follows:

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(j) Efforts to increase the number of HBCU & MI awarded subcontracts (DFAR 219.705.4) is as follows:

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(k) Obstacles in awarding subcontracts to SDB & HBCU/MI's currently on file are:

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(l) Indirect and overhead costs (check one below):

☐ have been ☐ have not been

included in the goals specified in 2.

If "have been" is checked, explain the method used in determining the proportionate share of indirect and overhead cost to be allocated as subcontracts to small business concerns and small disadvantaged business concerns.

\_\_\_\_\_  
\_\_\_\_\_

The following individual will administer the subcontracting program:

Name: \_\_\_\_\_ Title: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone Number: \_\_\_\_\_

This individual's specific duties, as they relate to the firm's subcontracting program, are as follows:

General overall responsibility for this company's Small Business Program, the development, preparation and execution of individual subcontracting plans and for monitoring performance relative to contractual subcontracting requirements contained in this plan, including but not limited to:

- (a) Developing and maintaining bidders lists of small and small disadvantaged business concerns from all possible sources.
- (b) Ensuring that procurement packages are structured to permit small and small disadvantaged business concerns to participate to the maximum extent possible.
- (c) Assuring inclusion of small and SDB concerns in all solicitations for products or services which they are capable of providing.
- (d) Reviewing solicitations to remove statements, clauses, etc. which may tend to restrict or prohibit SB and SDB participation.
- (e) Ensuring periodic rotation of potential subcontractors on bidders lists.
- (f) Ensuring that the bid proposal review board documents its reasons for not selecting low bids submitted by small and small disadvantaged business concerns.
- (g) Ensuring the establishment and maintenance of records of solicitations and subcontract award activity.
- (h) Attending or arranging for attendance of company counselors at Business Opportunity Workshops, Minority Business Enterprise Seminars, Trade Fairs, etc.
- (i) Monitoring attainment of proposal goals.
- (j) Preparing and submitting periodic subcontracting reports required.
- (k) Coordinating contractor's activities during the conduct of compliance reviews by Federal agencies.

(l) Counsel and discuss subcontracting opportunities with representatives of small and small disadvantaged business firms.

(m) Provide notice to subcontractors concerning penalties for misrepresentations of business status as small business or small disadvantaged business for the purpose of obtaining a subcontract.

(n) Coordinating the conduct of contractor's activities involving its small and small disadvantaged business subcontracting program.

(o) Additions to (or deletions from) the duties specified above are as follows:

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4. The following efforts will be taken to insure that small and small disadvantaged business concerns will have an equitable opportunity to compete for subcontracts:

(a) Outreach efforts will be made as follows:

(i) Efforts are made to contact and work with specific commercial, trade associations, minority and small business trade associations or governmental organizations to assist in identifying potential sources for items not traditionally awarded to Small Business and SDB's (FAR 52.219) are as follows:

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(ii) Contacts with business development organizations.

(iii) Attendance at small and minority business procurement conferences and trade fairs.

(iv) Sources will be requested from SBA's PASS system.

(b) The following internal efforts will be made to guide and encourage buyers:

(i) Workshops, seminars and training program will be conducted.

(ii) Activities will be monitored to evaluate compliance with this subcontracting plan.

(iii) Evaluation of the small and SDB award performance and program effectiveness (19.704(a)(6) against the established goals, company-wide and for all individual plans will be accomplished by:

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(iv) All efforts will be made to include small and SDB firms by name as members of the original team for providing major services.

(v) Special efforts will be made to establish long-range relationship, including leader-follower techniques (FAR 19.705-4(d)).

(c) Small and small disadvantaged business concern source lists, guides and other data identifying small and small disadvantaged business concerns will be maintained and utilized by buyers in soliciting subcontracts.

(d) In areas where appropriate, efforts to review HBCU/MI's for involvement in corporate planning or individual contract plan will be sought. (DFAR 219.705-4)

(e) Additions to (or deletions from) the above listed efforts are as follows:

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5. \_\_\_\_\_(Firm Name) agrees that the clause entitled Utilization of Small Business Concerns and Small Business Concerns Owned and Controlled by Socially and Economically Disadvantaged Individuals (FAR 52.219-8) will be included in all subcontracts that offer further subcontracting opportunities. All subcontractors except small business concerns who receive subcontracts in excess of \$500,000 (\$1,000,000 for Construction) will be required to adopt and comply with a subcontracting plan similar to this one. (FAR 19.708(b). Such plans will be reviewed by comparing them with the provisions of Public Law 95-507 and FAR Clause 52.219-9 and assuring that all minimum requirements of an acceptable subcontracting plan have been satisfied. The acceptability of percentage goals shall be determined on a case-by-case basis depending on the supplies/services involved, the availability of potential small and small disadvantaged subcontractors, and prior experience. Once approved and implemented, plans will be monitored through the submission of periodic reports, and/or, as time and availability of funds permit, periodic visits to subcontractors facilities to review applicable records and subcontracting program progress.

6. \_\_\_\_\_(Firm Name) agrees to submit such periodic reports, and cooperate in any studies or surveys as may be required by the contracting agency or the Small Business Administration in order to determine the extent of compliance by the bidder with the subcontracting plan and with the clause entitled Utilization of Small Business Concerns and Small Business Concerns Owned and Controlled by Socially and Economically Disadvantaged Individuals, contained in this contract. The Contractor further agrees to submit SF 294 and SF 295 in accordance with the instructions on the back of each form.

7. \_\_\_\_\_(Firm Name) agrees that they will maintain at least the following types of records to document compliance with this subcontracting plan:

(a) Small and small disadvantaged business concern source lists, guides and other data identifying SB/SDBC vendors.

(b) Organizations contacted for small and disadvantaged business sources.

(c) On a contract-by-contract basis, records on all subcontract solicitations over \$100,000, indicating on each solicitation (!) whether small business concerns were solicited, and if not, why not; (2) whether small disadvantaged business concerns were solicited, and if not, why not; and (3) reasons for the failure of solicited small or small disadvantaged business concerns to receive the subcontract award.

(d) Records to support other outreach efforts: Contacts with Minority and Small Business Trade Associations, etc. Attendance at small and minority business procurement conferences and trade fairs.

(e) Records to support internal activities to guide and encourage buyers; workshops, seminars, training programs, etc. Monitoring activities to evaluate compliance.

(f) On a contract-by-contract basis, records to support subcontract award data to include name and address of subcontractor.

(g) Records to be maintained in addition to the above are as follows:

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Contractor's Signature:\_\_\_\_\_

Typed Name:\_\_\_\_\_

Title:\_\_\_\_\_

Date:\_\_\_\_\_

This Plan is Accepted By:

\_\_\_\_\_  
Contracting Officer

Date:\_\_\_\_\_

## SECTION 00700 Contract Clauses

## CLAUSES INCORPORATED BY REFERENCE:

52.202-1 Alt I	Definitions (May 2001) --Alternate I	MAY 2001
52.203-3	Gratuities	APR 1984
52.203-5	Covenant Against Contingent Fees	APR 1984
52.203-6	Restrictions On Subcontractor Sales To The Government	JUL 1995
52.203-7	Anti-Kickback Procedures	JUL 1995
52.203-8	Cancellation, Rescission, and Recovery of Funds for Illegal or Improper Activity	JAN 1997
52.203-10	Price Or Fee Adjustment For Illegal Or Improper Activity	JAN 1997
52.203-12	Limitation On Payments To Influence Certain Federal Transactions	JUN 1997
52.204-4	Printed or Copied Double-Sided on Recycled Paper	AUG 2000
52.209-6	Protecting the Government's Interest When Subcontracting With Contractors Debarred, Suspended, or Proposed for Debarment	JUL 1995
52.211-13	Time Extensions	SEP 2000
52.211-15	Defense Priority And Allocation Requirements	SEP 1990
52.211-18	Variation in Estimated Quantity	APR 1984
52.215-2	Audit and Records--Negotiation	JUN 1999
52.215-11	Price Reduction for Defective Cost or Pricing Data--Modifications	OCT 1997
52.215-12	Subcontractor Cost or Pricing Data	OCT 1997
52.215-13	Subcontractor Cost or Pricing Data--Modifications	OCT 1997
52.215-14	Integrity of Unit Prices	OCT 1997
52.215-15	Pension Adjustments and Asset Reversions	DEC 1998
52.215-17	Waiver of Facilities Capital Cost of Money	OCT 1997
52.215-18	Reversion or Adjustment of Plans for Postretirement Benefits (PRB) Other than Pensions	OCT 1997
52.215-19	Notification of Ownership Changes	OCT 1997
52.215-21	Requirements for Cost or Pricing Data or Information Other Than Cost or Pricing Data--Modifications	OCT 1997
52.216-7 Alt I	Allowable Cost and Payment (Apr 1998) - Alternate I	FEB 1997
52.217-2	Cancellation Under Multiyear Contracts	OCT 1997
52.219-8	Utilization of Small Business Concerns	OCT 2000
52.219-9	Small Business Subcontracting Plan	OCT 2000
52.219-16	Liquidated Damages -Subcontracting Plan	JAN 1999
52.222-3	Convict Labor	AUG 1996
52.222-4	Contract Work Hours and Safety Standards Act - Overtime Compensation	SEP 2000
52.222-6	Davis Bacon Act	FEB 1995
52.222-7	Withholding of Funds	FEB 1988
52.222-8	Payrolls and Basic Records	FEB 1988
52.222-9	Apprentices and Trainees	FEB 1988
52.222-10	Compliance with Copeland Act Requirements	FEB 1988
52.222-11	Subcontracts (Labor Standards)	FEB 1988
52.222-12	Contract Termination-Debarment	FEB 1988
52.222-13	Compliance with Davis -Bacon and Related Act Regulations.	FEB 1988
52.222-14	Disputes Concerning Labor Standards	FEB 1988
52.222-15	Certification of Eligibility	FEB 1988
52.222-21	Prohibition Of Segregated Facilities	FEB 1999
52.222-26	Equal Opportunity	FEB 1999
52.222-27	Affirmative Action Compliance Requirements for Construction	FEB 1999

52.222-35	Affirmative Action For Disabled Veterans And Veterans of the Vietnam Era	APR 1998
52.222-36	Affirmative Action For Workers With Disabilities	JUN 1998
52.222-37	Employment Reports On Disabled Veterans And Veterans Of The Vietnam Era	JAN 1999
52.223-3	Hazardous Material Identification And Material Safety Data	JAN 1997
52.223-6	Drug Free Workplace	MAY 2001
52.223-14	Toxic Chemical Release Reporting	OCT 2000
52.225-13	Restrictions on Certain Foreign Purchases	JUL 2000
52.226-1	Utilization Of Indian Organizations And Indian-Owned Economic Enterprises	JUN 2000
52.227-1	Authorization and Consent	JUL 1995
52.227-2	Notice And Assistance Regarding Patent And Copyright Infringement	AUG 1996
52.227-4	Patent Indemnity-Construction Contracts	APR 1984
52.228-1	Bid Guarantee	SEP 1996
52.228-2	Additional Bond Security	OCT 1997
52.228-5	Insurance - Work On A Government Installation	JAN 1997
52.228-11	Pledges Of Assets	FEB 1992
52.228-14	Irrevocable Letter of Credit	DEC 1999
52.229-3	Federal, State And Local Taxes	JAN 1991
52.229-5	Taxes--Contracts Performed In U S Possessions Or Puerto Rico	APR 1984
52.230-2	Cost Accounting Standards	APR 1998
52.232-5	Payments under Fixed-Price Construction Contracts	MAY 1997
52.232-17	Interest	JUN 1996
52.232-23 Alt I	Assignment of Claims (Jan 1986) - Alternate I	APR 1984
52.232-33	Payment by Electronic Funds Transfer--Central Contractor Registration	MAY 1999
52.233-1	Disputes	DEC 1998
52.233-3	Protest After Award	AUG 1996
52.236-3	Site Investigation and Conditions Affecting the Work	APR 1984
52.236-5	Material and Workmanship	APR 1984
52.236-6	Superintendence by the Contractor	APR 1984
52.236-8	Other Contracts	APR 1984
52.236-10	Operations and Storage Areas	APR 1984
52.236-11	Use and Possession Prior to Completion	APR 1984
52.236-12	Cleaning Up	APR 1984
52.236-13	Accident Prevention	NOV 1991
52.236-15	Schedules for Construction Contracts	APR 1984
52.236-17	Layout of Work	APR 1984
52.236-21 Alt I	Specifications and Drawings for Construction (Feb 97) - Alternate I	APR 1984
52.236-26	Preconstruction Conference	FEB 1995
52.242-13	Bankruptcy	JUL 1995
52.242-14	Suspension of Work	APR 1984
52.244-5	Competition In Subcontracting	DEC 1996
52.244-6	Subcontracts for Commercial Items and Commercial Components	MAY 2001
52.245-1	Property Records	APR 1984
52.245-2	Government Property (Fixed Price Contracts)	DEC 1989
52.246-12	Inspection of Construction	AUG 1996
52.247-34	F.O.B. Destination	NOV 1991
52.248-3	Value Engineering -Construction	FEB 2000
52.249-2 Alt I	Termination for Convenience of the Government (Fixed-Price) (Sep 1996) - Alternate I	SEP 1996
52.249-10	Default (Fixed-Price Construction)	APR 1984
52.253-1	Computer Generated Forms	JAN 1991



252.201-7000	Contracting Officer's Representative	DEC 1991
252.203-7001	Prohibition On Persons Convicted of Fraud or Other Defense- Contract-Related Felonies	MAR 1999
252.203-7002	Display Of DOD Hotline Poster	DEC 1991
252.204-7003	Control Of Government Personnel Work Product	APR 1992
252.204-7004	Required Central Contractor Registration	MAR 2000
252.205-7000	Provisions Of Information To Cooperative Agreement Holders	DEC 1991
252.209-7000	Acquisition From Subcontractors Subject To On -Site Inspection Under The Intermediate Range Nuclear Forces (INF) Treaty	NOV 1995
252.209-7003	Compliance With Veterans' Employment Reporting Requirements	MAR 1998
252.209-7004	Subcontracting With Firms That Are Owned or Controlled By The Government of a Terrorist Country	MAR 1998
252.215-7000	Pricing Adjustments	DEC 1991
252.215-7002	Cost Estimating System Requirements	OCT 1998
252.219-7003	Small, Small Disadvantaged and Women-Owned Small Business Subcontracting Plan (DOD Contracts)	APR 1996
252.225-7012	Preference For Certain Domestic Commodities	AUG 2000
252.225-7031	Secondary Arab Boycott Of Israel	JUN 1992
252.227-7033	Rights in Shop Drawings	APR 1966
252.231-7000	Supplemental Cost Principles	DEC 1991
252.236-7000	Modification Proposals -Price Breakdown	DEC 1991
252.236-7006	Cost Limitation	JAN 1997
252.243-7001	Pricing Of Contract Modifications	DEC 1991
252.243-7002	Requests for Equitable Adjustment	MAR 1998
252.244-7000	Subcontracts for Commercial Items and Commercial Components (DoD Contracts)	MAR 2000
252.245-7001	Reports Of Government Property	MAY 1994
252.246-7000	Material Inspection And Receiving Report	DEC 1991
252.247-7023	Transportation of Supplies by Sea	MAR 2000
252.247-7024	Notification Of Transportation Of Supplies By Sea	MAR 2000
252.248-7000	Preparation Of Value Engineering Change Proposal	MAY 1994

#### CLAUSES INCORPORATED BY FULL TEXT

##### 52.219-4 NOTICE OF PRICE EVALUATION PREFERENCE FOR HUBZONE SMALL BUSINESS CONCERNS (JAN 1999)

(a) Definition. HUBZone small business concern, as used in this clause, means a small business concern that appears on the List of Qualified HUBZone Small Business Concerns maintained by the Small Business Administration.

(b) Evaluation preference. (1) Offers will be evaluated by adding a factor of 10 percent to the price of all offers, except--

(i) Offers from HUBZone small business concerns that have not waived the evaluation preference;

(ii) Otherwise successful offers from small business concerns;

(iii) Otherwise successful offers of eligible products under the Trade Agreements Act when the dollar threshold for application of the Act is exceeded (see 25.402 of the Federal Acquisition Regulation (FAR)); and

(iv) Otherwise successful offers where application of the factor would be inconsistent with a Memorandum of Understanding or other international agreement with a foreign government.

(2) The factor of 10 percent shall be applied on a line item basis or to any group of items on which award may be made. Other evaluation factors described in the solicitation shall be applied before application of the factor.

(3) A concern that is both a HUBZone small business concern and a small disadvantaged business concern will receive the benefit of both the HUBZone small business price evaluation preference and the small disadvantaged business price evaluation adjustment (see FAR clause 52.219-23). Each applicable price evaluation preference or adjustment shall be calculated independently against an offeror's base offer.

These individual preference amounts shall be added together to arrive at the total evaluated price for that offer.

(c) Waiver of evaluation preference. A HUBZone small business concern may elect to waive the evaluation preference, in which case the factor will be added to its offer for evaluation purposes. The agreements in paragraph (d) of this clause do not apply if the offeror has waived the evaluation preference.

\_\_\_ Offeror elects to waive the evaluation preference.

(d) Agreement. A HUBZone small business concern agrees that in the performance of the contract, in the case of a contract for

(1) Services (except construction), at least 50 percent of the cost of personnel for contract performance will be spent for employees of the concern or employees of other HUBZone small business concerns;

(2) Supplies (other than procurement from a nonmanufacturer of such supplies), at least 50 percent of the cost of manufacturing, excluding the cost of materials, will be performed by the concern or other HUBZone small business concerns;

(3) General construction, at least 15 percent of the cost of the contract performance incurred for personnel will be spent on the concern's employees or the employees of other HUBZone small business concerns; or

(4) Construction by special trade contractors, at least 25 percent of the cost of the contract performance incurred for personnel will be spent on the concern's employees or the employees of other HUBZone small business concerns.

(e) A HUBZone joint venture agrees that in the performance of the contract, the applicable percentage specified in paragraph (d) of this clause will be performed by the HUBZone small business participant or participants.

(f) A HUBZone small business concern nonmanufacturer agrees to furnish in performing this contract only end items manufactured or produced by HUBZone small business manufacturer concerns. This paragraph does not apply in connection with construction or service contracts.

(End of clause)

#### 52.225-11 BUY AMERICAN ACT--BALANCE OF PAYMENTS PROGRAM--CONSTRUCTION MATERIALS UNDER TRADE AGREEMENTS (FEB 2000)

(a) Definitions. As used in this clause--

Component means any article, material, or supply incorporated directly into construction materials.

Construction material means an article, material, or supply brought to the construction site by the Contractor or subcontractor for incorporation into the building or work. The term also includes an item brought to the site preassembled from articles, materials, or supplies. However, emergency life safety systems, such as emergency lighting, fire alarm, and audio evacuation systems, that are discrete systems incorporated into a public building or work and that are produced as complete systems, are evaluated as a single and distinct construction material regardless of when or how the individual parts or components of those systems are delivered to the construction site. Materials purchased directly by the Government are supplies, not construction material.

Cost of components means--

(1) For components purchased by the Contractor, the acquisition cost, including transportation costs to the place of incorporation into the end product (whether or not such costs are paid to a domestic firm), and any applicable duty (whether or not a duty-free entry certificate is issued); or

(2) For components manufactured by the Contractor, all costs associated with the manufacture of the component, including transportation costs as described in paragraph (1) of this definition, plus allocable overhead costs, but excluding profit. Cost of components does not include any costs associated with the manufacture of the end product.

Designated country means any of the following countries: Aruba, Austria, Bangladesh, Belgium, Benin, Bhutan, Botswana, Burkina Faso, Burundi, Canada, Cape Verde, Central African Republic, Chad, Comoros, Denmark.

Djibouti, Equatorial Guinea, Finland, France, Gambia, Germany, Greece, Guinea, Guinea-Bissau, Haiti, Hong Kong, Ireland, Israel, Italy, Japan.

Kiribati, Korea, Republic of, Lesotho, Liechtenstein, Luxembourg, Malawi, Maldives, Mali, Mozambique, Nepal, Netherlands, Niger, Norway, Portugal, Rwanda.

Sao Tome and Principe, Sierra Leone, Singapore, Somalia, Spain, Sweden, Switzerland, Tanzania U.R., Togo, Tuvalu, Uganda, United Kingdom, Vanuatu, Western Samoa, Yemen.

Designated country construction material means a construction material that--

(1) Is wholly the growth, product, or manufacture of a designated country; or

(2) In the case of a construction material that consists in whole or in part of materials from another country, has been substantially transformed in a designated country into a new and different construction material distinct from the materials from which it was transformed.

Domestic construction material means--

(1) An unmanufactured construction material mined or produced in the United States; or

(2) A construction material manufactured in the United States, if the cost of its components mined, produced, or manufactured in the United States exceeds 50 percent of the cost of all its components. Components of foreign origin of the same class or kind for which nonavailability determinations have been made are treated as domestic.

Foreign construction material means a construction material other than a domestic construction material.

North American Free Trade Agreement country means Canada or Mexico.

North American Free Trade Agreement country construction material means a construction material that--

(1) Is wholly the growth, product, or manufacture of a North American Free Trade Agreement (NAFTA) country; or

(2) In the case of a construction material that consists in whole or in part of materials from another country, has been substantially transformed in a NAFTA country into a new and different construction material distinct from the materials from which it was transformed.

United States means the 50 States and the District of Columbia, U.S. territories and possessions, Puerto Rico, the Northern Mariana Islands, and any other place subject to U.S. jurisdiction, but does not include leased bases.

(b) Construction materials. (1) This clause implements the Buy American Act (41 U.S.C. 10a-10d) and the Balance of Payments Program by providing a preference for domestic construction material. In addition, the Contracting Officer has determined that the Trade Agreements Act and the North American Free Trade Agreement (NAFTA) apply to this acquisition. Therefore, the Buy American Act and Balance of Payments Program restrictions are waived for designated country and NAFTA country construction materials.

(2) The Contractor shall use only domestic, designated country, or NAFTA country construction material in performing this contract, except as provided in paragraphs (b)(3) and (b)(4) of this clause.

(3) The requirement in paragraph (b)(2) of this clause does not apply to the construction materials or components listed by the Government as follows:

The following articles have been determined to be non-available in accordance with FAR 25.103(b):

Acetylene, black.  
 Agar, bulk.  
 Anise.  
 Antimony, as metal or oxide.  
 Asbestos, amosite, chrysotile, and crocidolite.  
 Bananas.  
 Bauxite.  
 Beef, corned, canned.  
 Beef extract.  
 Bephenium hydroxynapthoate.  
 Bismuth.  
 Books, trade, text, technical, or scientific; newspapers; pamphlets; magazines; periodicals; printed briefs and films; not printed in the United States and for which domestic editions are not available.  
 Brazil nuts, unroasted.  
 Cadmium, ores and flue dust.  
 Calcium cyanamide.  
 Capers.  
 Cashew nuts.  
 Castor beans and castor oil.  
 Chalk, English.  
 Chestnuts.  
 Chicle.  
 Chrome ore or chromite.  
 Cinchona bark.  
 Cobalt, in cathodes, rondelles, or other primary ore and metal forms.  
 Cocoa beans.  
 Coconut and coconut meat, unsweetened, in shredded, desiccated, or similarly prepared form.  
 Coffee, raw or green bean.  
 Colchicine alkaloid, raw.  
 Copra.  
 Cork, wood or bark and waste.  
 Cover glass, microscope slide.  
 Crane rail (85-pound per foot).  
 Cryolite, natural.  
 Dammar gum.  
 Diamonds, industrial, stones and abrasives.  
 Emetine, bulk.  
 Ergot, crude.  
 Erythrityl tetranitrate.  
 Fair linen, altar.  
 Fibers of the following types: abaca, abace, agave, coir, flax, jute, jute burlaps, palmyra, and sisal.

Goat and kidskins.  
Graphite, natural, crystalline, crucible grade.  
Hand file sets (Swiss pattern).  
Handsewing needles.  
Hemp yarn.  
Hog bristles for brushes.  
Hyoscine, bulk.  
Ipecac, root.  
Iodine, crude.  
Kaurigum.  
Lac.  
Leather, sheepskin, hair type.  
Lavender oil.  
Manganese.  
Menthol, natural bulk.  
Mica.  
Microprocessor chips (brought onto a Government construction site as separate units for incorporation into building systems during construction or repair and alteration of real property).  
Nickel, primary, in ingots, pigs, shots, cathodes, or similar forms; nickel oxide and nickel salts.  
Nitroguanidine (also known as picrite).  
Nux vomica, crude.  
Oiticica oil.  
Olive oil.  
Olives (green), pitted or unpitted, or stuffed, in bulk.  
Opium, crude.  
Oranges, mandarin, canned.  
Petroleum, crude oil, unfinished oils, and finished products.  
Pine needle oil.  
Platinum and related group metals, refined, as sponge, powder, ingots, or cast bars.  
Pyrethrum flowers.  
Quartz crystals.  
Quebracho.  
Quinidine.  
Quinine.  
Rabbit fur felt.  
Radium salts, source and special nuclear materials.  
Rosettes.  
Rubber, crude and latex.  
Rutile.  
Santonin, crude.  
Secretin.  
Shellac.  
Silk, raw and unmanufactured.  
Spare and replacement parts for equipment of foreign manufacture, and for which domestic parts are not available.  
Spices and herbs, in bulk.  
Sugars, raw.  
Swords and scabbards.  
Talc, block, steatite.  
Tantalum.  
Tapioca flour and cassava.  
Tartar, crude; tartaric acid and cream of tartar in bulk.  
Tea in bulk.  
Thread, metallic (gold).  
Thyme oil.

Tin in bars, blocks, and pigs.  
 Triprolidine hydrochloride.  
 Tungsten.  
 Vanilla beans.  
 Venom, cobra.  
 Wax, carnauba.  
 Wire glass.  
 Woods; logs, veneer, and lumber of the following species: Alaskan yellow cedar, angelique, balsa, ekki, greenheart, lignum vitae, mahogany, and teak.  
 Yarn, 50 Denier rayon.

The determination in paragraph (a) of this section does not apply if the contracting officer learns before the time designated for receipt of bids in sealed bidding or final offers in negotiation that an article on the list is available domestically in sufficient and reasonably available quantities of a satisfactory quality.

(4) The Contracting Officer may add other foreign construction material to the list in paragraph (b)(3) of this clause if the Government determines that--

(i) The cost of domestic construction material would be unreasonable. The cost of a particular domestic construction material subject to the restrictions of the Buy American Act is unreasonable when the cost of such material exceeds the cost of foreign material by more than 6 percent. For determination of unreasonable cost under the Balance of Payments Program, the Contracting Officer will use a factor of 50 percent;

(ii) The application of the restriction of the Buy American Act or Balance of Payments Program to a particular construction material would be impracticable or inconsistent with the public interest; or

(iii) The construction material is not mined, produced, or manufactured in the United States in sufficient and reasonably available commercial quantities of a satisfactory quality.

(c) Request for determination of inapplicability of the Buy American Act or Balance of Payments Program. (1)(i) Any Contractor request to use foreign construction material in accordance with paragraph (b)(4) of this clause shall include adequate information for Government evaluation of the request, including--

(A) A description of the foreign and domestic construction materials;

(B) Unit of measure;

(C) Quantity;

(D) Price;

(E) Time of delivery or availability;

(F) Location of the construction project;

(G) Name and address of the proposed supplier; and

(H) A detailed justification of the reason for use of foreign construction materials cited in accordance with paragraph (b)(3) of this clause.

(ii) A request based on unreasonable cost shall include a reasonable survey of the market and a completed price comparison table in the format in paragraph (d) of this clause.

(iii) The price of construction material shall include all delivery costs to the construction site and any applicable duty (whether or not a duty-free certificate may be issued).

(iv) Any Contractor request for a determination submitted after contract award shall explain why the Contractor could not reasonably foresee the need for such determination and could not have requested the determination before contract award. If the Contractor does not submit a satisfactory explanation, the Contracting Officer need not make a determination.

(2) If the Government determines after contract award that an exception to the Buy American Act or Balance of Payments Program applies and the Contracting Officer and the Contractor negotiate adequate consideration, the Contracting Officer will modify the contract to allow use of the foreign construction material. However, when the basis for the exception is the unreasonable price of a domestic construction material, adequate consideration is not less than the differential established in paragraph (b)(4)(i) of this clause.

(3) Unless the Government determines that an exception to the Buy American Act or Balance of Payments Program applies, use of foreign construction material is noncompliant with the Buy American Act or Balance of Payments Program.

(d) Data. To permit evaluation of requests under paragraph (c) of this clause based on unreasonable cost, the Contractor shall include the following information and any applicable supporting data based on the survey of suppliers:

**Foreign and Domestic Construction Materials Price Comparison**

Construction Material Description	Unit of Measure	Quantity	Price (Dollars) \\
Item 1:			
Foreign construction material.	.....	.....	.....
Domestic construction material.	.....	.....	.....
Item 2:			
Foreign construction material.	.....	.....	.....
Domestic construction material.	.....	.....	.....

*\\Include all delivery costs to the construction site and any applicable duty (whether or not a duty-free entry certificate is issued). List name, address, telephone number, and contact for suppliers surveyed. Attach copy of response; if oral, attach summary. Include other applicable supporting information.*

(End of Clause)

**52.228-15 PERFORMANCE AND PAYMENT BONDS--CONSTRUCTION (JUL 2000)-**

(a) Definitions. As used in this clause--

Original contract price means the award price of the contract; or, for requirements contracts, the price payable for the estimated total quantity; or, for indefinite-quantity contracts, the price payable for the specified minimum quantity. Original contract price does not include the price of any options, except those options exercised at the time of contract award.

(b) Amount of required bonds. Unless the resulting contract price is \$100,000 or less, the successful offeror shall furnish performance and payment bonds to the Contracting Officer as follows:

(1) Performance bonds (Standard Form 25). The penal amount of performance bonds at the time of contract award shall be 100 percent of the original contract price.

(2) Payment Bonds (Standard Form 25-A). The penal amount of payment bonds at the time of contract award shall be 100 percent of the original contract price.

(3) Additional bond protection. (i) The Government may require additional performance and payment bond protection if the contract price is increased. The increase in protection generally will equal 100 percent of the increase in contract price.

(ii) The Government may secure the additional protection by directing the Contractor to increase the penal amount of the existing bond or to obtain an additional bond.

(c) Furnishing executed bonds. The Contractor shall furnish all executed bonds, including any necessary reinsurance agreements, to the Contracting Officer, within the time period specified in the Bid Guarantee provision of the solicitation, or otherwise specified by the Contracting Officer, but in any event, before starting work.

(d) Surety or other security for bonds. The bonds shall be in the form of firm commitment, supported by corporate sureties whose names appear on the list contained in Treasury Department Circular 570, individual sureties, or by other acceptable security such as postal money order, certified check, cashier's check, irrevocable letter of credit, or, in accordance with Treasury Department regulations, certain bonds or notes of the United States. Treasury Circular 570 is published in the Federal Register or may be obtained from the U.S. Department of Treasury, Financial Management Service, Surety Bond Branch, 401 14th Street, NW, 2nd Floor, West Wing, Washington, DC 20227.

(e) Notice of subcontractor waiver of protection (40 U.S.C. 270b(c)). Any waiver of the right to sue on the payment bond is void unless it is in writing, signed by the person whose right is waived, and executed after such person has first furnished labor or material for use in the performance of the contract.

(End of clause)

#### 52.232-27 PROMPT PAYMENT FOR CONSTRUCTION CONTRACTS (MAY 2001)

Notwithstanding any other payment terms in this contract, the Government will make invoice payments and contract financing payments under the terms and conditions specified in this clause. Payment shall be considered as being made on the day a check is dated or the date of an electronic funds transfer. Definitions of pertinent terms are set forth in sections 2.101 and 32.902 of the Federal Acquisition Regulation. All days referred to in this clause are calendar days, unless otherwise specified. (However, see subparagraph (a)(3) concerning payments due on Saturdays, Sundays, and legal holidays.)

(a) Invoice payments. (1) Types of invoice payments. For purposes of this clause, there are several types of invoice payments that may occur under this contract, as follows:

(i) Progress payments, if provided for elsewhere in this contract, based on Contracting Officer approval of the estimated amount and value of work or services performed, including payments for reaching milestones in any project:

(A) The due date for making such payments shall be 14 days after receipt of the payment request by the designated billing office. If the designated billing office fails to annotate the payment request with the actual date of receipt at the time of receipt, the payment due date shall be the 14th day after the date of the Contractor's payment request, provided a proper payment request is received and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(B) The due date for payment of any amounts retained by the Contracting Officer in accordance with the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts, shall be as specified in the contract or, if not specified, 30 days after approval for release to the Contractor by the Contracting Officer.

(ii) Final payments based on completion and acceptance of all work and presentation of release of all claims against the Government arising by virtue of the contract, and payments for partial deliveries that have been accepted by the Government (e.g., each separate building, public work, or other division of the contract for which the price is stated separately in the contract):



(A) The due date for making such payments shall be either the 30th day after receipt by the designated billing office of a proper invoice from the Contractor, or the 30th day after Government acceptance of the work or services completed by the Contractor, whichever is later. If the designated billing office fails to annotate the invoice with the date of actual receipt at the time of receipt, the invoice payment due date shall be the 30th day after the date of the Contractor's invoice, provided a proper invoice is received and there is no disagreement over quantity, quality, or Contractor compliance with contract requirements.

(B) On a final invoice where the payment amount is subject to contract settlement actions (e.g., release of claims), acceptance shall be deemed to have occurred on the effective date of the contract settlement.

(2) Contractor's invoice. The Contractor shall prepare and submit invoices to the designated billing office specified in the contract. A proper invoice must include the items listed in subdivisions (a)(2)(i) through (a)(2)(ix) of this clause. If the invoice does not comply with these requirements, it shall be returned within 7 days after the date the designated billing office received the invoice, with a statement of the reasons why it is not a proper invoice. Untimely notification will be taken into account in computing any interest penalty owed the Contractor in the manner described in subparagraph (a)(4) of this clause.

(i) Name and address of the Contractor.

(ii) Invoice date. (The Contractor is encouraged to date invoices as close as possible to the date of mailing or transmission.)

(iii) Contract number or other authorization for work or services performed (including order number and contract line item number).

(iv) Description of work or services performed.

(v) Delivery and payment terms (e.g., prompt payment discount terms).

(vi) Name and address of Contractor official to whom payment is to be sent (must be the same as that in the contract or in a proper notice of assignment).

(vii) Name (where practicable), title, phone number, and mailing address of person to be notified in the event of a defective invoice.

(viii) For payments described in subdivision (a)(1)(i) of this clause, substantiation of the amounts requested and certification in accordance with the requirements of the clause at 52.232-5, Payments Under Fixed-Price Construction Contracts.

(ix) Any other information or documentation required by the contract.

(x) While not required, the Contractor is strongly encouraged to assign an identification number to each invoice.

(3) Interest penalty. An interest penalty shall be paid automatically by the designated payment office, without request from the Contractor, if payment is not made by the due date and the conditions listed in subdivisions (a)(3)(i) through (a)(3)(iii) of this clause are met, if applicable. However, when the due date falls on a Saturday, Sunday, or legal holiday when Federal Government offices are closed and Government business is not expected to be conducted, payment may be made on the following business day without incurring a late payment interest penalty.

(i) A proper invoice was received by the designated billing office.

(ii) A receiving report or other Government documentation authorizing payment was processed and there was no disagreement over quantity, quality, Contractor compliance with any contract term or condition, or requested

progress payment amount.

(iii) In the case of a final invoice for any balance of funds due the Contractor for work or services performed, the amount was not subject to further contract settlement actions between the Government and the Contractor.

(4) Computing penalty amount. The interest penalty shall be at the rate established by the Secretary of the Treasury under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) that is in effect on the day after the due date, except where the interest penalty is prescribed by other governmental authority (e.g., tariffs). This rate is referred to as the "Renegotiation Board Interest Rate," and it is published in the Federal Register semiannually on or about January 1 and July 1. The interest penalty shall accrue daily on the invoice principal payment amount approved by the Government until the payment date of such approved principal amount; and will be compounded in 30-day increments inclusive from the first day after the due date through the payment date. That is, interest accrued at the end of any 30-day period will be added to the approved invoice principal payment amount and will be subject to interest penalties if not paid in the succeeding 30-day period. If the designated billing office failed to notify the Contractor of a defective invoice within the periods prescribed in subparagraph (a)(2) of this clause, the due date on the corrected invoice will be adjusted by subtracting from such date the number of days taken beyond the prescribed notification of defects period. Any interest penalty owed the Contractor will be based on this adjusted due date. Adjustments will be made by the designated payment office for errors in calculating interest penalties.

(i) For the sole purpose of computing an interest penalty that might be due the Contractor for payments described in subdivision (a)(1)(ii) of this clause, Government acceptance or approval shall be deemed to have occurred constructively on the 7th day after the Contractor has completed the work or services in accordance with the terms and conditions of the contract. In the event that actual acceptance or approval occurs within the constructive acceptance or approval period, the determination of an interest penalty shall be based on the actual date of acceptance or approval. Constructive acceptance or constructive approval requirements do not apply if there is a disagreement over quantity, quality, or Contractor compliance with a contract provision. These requirements also do not compel Government officials to accept work or services, approve Contractor estimates, perform contract administration functions, or make payment prior to fulfilling their responsibilities.

(ii) The following periods of time will not be included in the determination of an interest penalty:

(A) The period taken to notify the Contractor of defects in invoices submitted to the Government, but this may not exceed 7 days.

(B) The period between the defects notice and resubmission of the corrected invoice by the Contractor.

(C) For incorrect electronic funds transfer (EFT) information, in accordance with the EFT clause of this contract.

(iii) Interest penalties will not continue to accrue after the filing of a claim for such penalties under the clause at 52.233-1, Disputes, or for more than 1 year. Interest penalties of less than \$1 need not be paid.

(iv) Interest penalties are not required on payment delays due to disagreement between the Government and the Contractor over the payment amount or other issues involving contract compliance, or on amounts temporarily withheld or retained in accordance with the terms of the contract. Claims involving disputes, and any interest that may be payable, will be resolved in accordance with the clause at 52.233-1, Disputes.

(5) Prompt payment discounts. An interest penalty also shall be paid automatically by the designated payment office, without request from the Contractor, if a discount for prompt payment is taken improperly. The interest penalty will be calculated on the amount of discount taken for the period beginning with the first day after the end of the discount period through the date when the Contractor is paid.

(6) Additional interest penalty. (i) If this contract was awarded on or after October 1, 1989, a penalty amount, calculated in accordance with subdivision (a)(6)(iii) of this clause, shall be paid in addition to the interest penalty amount if the Contractor--

(A) Is owed an interest penalty of \$1 or more;

(B) Is not paid the interest penalty within 10 days after the date the invoice amount is paid; and

(C) Makes a written demand to the designated payment office for additional penalty payment, in accordance with subdivision (a)(6)(ii) of this clause, postmarked not later than 40 days after the date the invoice amount is paid.

(ii)(A) Contractors shall support written demands for additional penalty payments with the following data. No additional data shall be required. Contractors shall--

(1) Specifically assert that late payment interest is due under a specific invoice, and request payment of all overdue late payment interest penalty and such additional penalty as may be required;

(2) Attach a copy of the invoice on which the unpaid late payment interest was due; and

(3) State that payment of the principal has been received, including the date of receipt.

(B) Demands must be postmarked on or before the 40th day after payment was made, except that--

(1) If the postmark is illegible or nonexistent, the demand must have been received and annotated with the date of receipt by the designated payment office on or before the 40th day after payment was made; or

(2) If the postmark is illegible or nonexistent and the designated payment office fails to make the required annotation, the demand's validity will be determined by the date the Contractor has placed on the demand; provided such date is no later than the 40th day after payment was made.

(iii)(A) The additional penalty shall be equal to 100 percent of any original late payment interest penalty, except--

(1) The additional penalty shall not exceed \$5,000;

(2) The additional penalty shall never be less than \$25; and

(3) No additional penalty is owed if the amount of the underlying interest penalty is less than \$1.

(B) If the interest penalty ceases to accrue in accordance with the limits stated in subdivision (a)(4)(iii) of this clause, the amount of the additional penalty shall be calculated on the amount of interest penalty that would have accrued in the absence of these limits, subject to the overall limits on the additional penalty specified in subdivision (a)(6)(iii)(A) of this clause.

(C) For determining the maximum and minimum additional penalties, the test shall be the interest penalty due on each separate payment made for each separate contract. The maximum and minimum additional penalty shall not be based upon individual invoices unless the invoices are paid separately. Where payments are consolidated for disbursing purposes, the maximum and minimum additional penalty determination shall be made separately for each contract therein.

(D) The additional penalty does not apply to payments regulated by other Government regulations (e.g., payments under utility contracts subject to tariffs and regulation).

(b) Contract financing payments. (1) Due dates for recurring financing payments. If this contract provides for contract financing, requests for payment shall be submitted to the designated billing office as specified in this contract or as directed by the Contracting Officer. Contract financing payments shall be made on the [insert day as prescribed by Agency head; if not prescribed, insert 30th day] day after receipt of a proper contract financing request by the designated billing office. In the event that an audit or other review of a specific financing request is required to ensure compliance with the terms and conditions of the contract, the designated payment office is not compelled to make payment by the due date specified.

(2) Due dates for other contract financing. For advance payments, loans, or other arrangements that do not involve recurring submissions of contract financing requests, payment shall be made in accordance with the corresponding contract terms or as directed by the Contracting Officer.

(3) Interest penalty not applicable. Contract financing payments shall not be assessed an interest penalty for payment delays.

(c) Subcontract clause requirements. The Contractor shall include in each subcontract for property or services (including a material supplier) for the purpose of performing this contract the following:

(1) Prompt payment for subcontractors. A payment clause that obligates the Contractor to pay the subcontractor for satisfactory performance under its subcontract not later than 7 days from receipt of payment out of such amounts as are paid to the Contractor under this contract.

(2) Interest for subcontractors. An interest penalty clause that obligates the Contractor to pay to the subcontractor an interest penalty for each payment not made in accordance with the payment clause--

(i) For the period beginning on the day after the required payment date and ending on the date on which payment of the amount due is made; and

(ii) Computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contract Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(3) Subcontractor clause flowdown. A clause requiring each subcontractor to include a payment clause and an interest penalty clause conforming to the standards set forth in subparagraphs (c)(1) and (c)(2) of this clause in each of its subcontracts, and to require each of its subcontractors to include such clauses in their subcontracts with each lower-tier subcontractor or supplier.

(d) Subcontract clause interpretation. The clauses required by paragraph (c) of this clause shall not be construed to impair the right of the Contractor or a subcontractor at any tier to negotiate, and to include in their subcontract, provisions that--

(1) Retainage permitted. Permit the Contractor or a subcontractor to retain (without cause) a specified percentage of each progress payment otherwise due to a subcontractor for satisfactory performance under the subcontract without incurring any obligation to pay a late payment interest penalty, in accordance with terms and conditions agreed to by the parties to the subcontract, giving such recognition as the parties deem appropriate to the ability of a subcontractor to furnish a performance bond and a payment bond;

(2) Withholding permitted. Permit the Contractor or subcontractor to make a determination that part or all of the subcontractor's request for payment may be withheld in accordance with the subcontract agreement; and

(3) Withholding requirements. Permit such withholding without incurring any obligation to pay a late payment penalty if--

(i) A notice conforming to the standards of paragraph (g) of this clause previously has been furnished to the subcontractor; and

(ii) A copy of any notice issued by a Contractor pursuant to subdivision (d)(3)(i) of this clause has been furnished to the Contracting Officer.

(e) Subcontractor withholding procedures. If a Contractor, after making a request for payment to the Government but before making a payment to a subcontractor for the subcontractor's performance covered by the payment request, discovers that all or a portion of the payment otherwise due such subcontractor is subject to withholding

from the subcontractor in accordance with the subcontract agreement, then the Contractor shall--

(1) Subcontractor notice. Furnish to the subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon as practicable upon ascertaining the cause giving rise to a withholding, but prior to the due date for subcontractor payment;

(2) Contracting Officer notice. Furnish to the Contracting Officer, as soon as practicable, a copy of the notice furnished to the subcontractor pursuant to subparagraph (e)(1) of this clause;

(3) Subcontractor progress payment reduction. Reduce the subcontractor's progress payment by an amount not to exceed the amount specified in the notice of withholding furnished under subparagraph (e)(1) of this clause;

(4) Subsequent subcontractor payment. Pay the subcontractor as soon as practicable after the correction of the identified subcontract performance deficiency, and--

(i) Make such payment within--

(A) Seven days after correction of the identified subcontract performance deficiency (unless the funds therefor must be recovered from the Government because of a reduction under subdivision (e)(5)(i)) of this clause; or

(B) Seven days after the Contractor recovers such funds from the Government; or

(ii) Incur an obligation to pay a late payment interest penalty computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty;

(5) Notice to Contracting Officer. Notify the Contracting Officer upon--

(i) Reduction of the amount of any subsequent certified application for payment; or

(ii) Payment to the subcontractor of any withheld amounts of a progress payment, specifying--

(A) The amounts withheld under subparagraph (e)(1) of this clause; and

(B) The dates that such withholding began and ended; and

(6) Interest to Government. Be obligated to pay to the Government an amount equal to interest on the withheld payments (computed in the manner provided in 31 U.S.C. 3903(c)(1)), from the 8th day after receipt of the withheld amounts from the Government until--

(i) The day the identified subcontractor performance deficiency is corrected; or

(ii) The date that any subsequent payment is reduced under subdivision (e)(5)(i) of this clause.

(f) Third-party deficiency reports. (1) Withholding from subcontractor. If a Contractor, after making payment to a first-tier subcontractor, receives from a supplier or subcontractor of the first-tier subcontractor (hereafter referred to as a "second-tier subcontractor") a written notice in accordance with section 2 of the Act of August 24, 1935 (40 U.S.C. 270b, Miller Act), asserting a deficiency in such first-tier subcontractor's performance under the contract for which the Contractor may be ultimately liable, and the Contractor determines that all or a portion of future payments otherwise due such first-tier subcontractor is subject to withholding in accordance with the subcontract agreement, the Contractor may, without incurring an obligation to pay an interest penalty under subparagraph (e)(6) of this clause--

(i) Furnish to the first-tier subcontractor a notice conforming to the standards of paragraph (g) of this clause as soon

as practicable upon making such determination; and

(ii) Withhold from the first-tier subcontractor's next available progress payment or payments an amount not to exceed the amount specified in the notice of withholding furnished under subdivision (f)(1)(i) of this clause.

(2) Subsequent payment or interest charge. As soon as practicable, but not later than 7 days after receipt of satisfactory written notification that the identified subcontract performance deficiency has been corrected, the Contractor shall--

(i) Pay the amount withheld under subdivision (f)(1)(ii) of this clause to such first-tier subcontractor; or

(ii) Incur an obligation to pay a late payment interest penalty to such first-tier subcontractor computed at the rate of interest established by the Secretary of the Treasury, and published in the Federal Register, for interest payments under section 12 of the Contracts Disputes Act of 1978 (41 U.S.C. 611) in effect at the time the Contractor accrues the obligation to pay an interest penalty.

(g) Written notice of subcontractor withholding. A written notice of any withholding shall be issued to a subcontractor (with a copy to the Contracting Officer of any such notice issued by the Contractor), specifying--

(1) The amount to be withheld;

(2) The specific causes for the withholding under the terms of the subcontract; and

(3) The remedial actions to be taken by the subcontractor in order to receive payment of the amounts withheld.

(h) Subcontractor payment entitlement. The Contractor may not request payment from the Government of any amount withheld or retained in accordance with paragraph (d) of this clause until such time as the Contractor has determined and certified to the Contracting Officer that the subcontractor is entitled to the payment of such amount.

(i) Prime-subcontractor disputes. A dispute between the Contractor and subcontractor relating to the amount or entitlement of a subcontractor to a payment or a late payment interest penalty under a clause included in the subcontract pursuant to paragraph (c) of this clause does not constitute a dispute to which the United States is a party. The United States may not be interpleaded in any judicial or administrative proceeding involving such a dispute.

(j) Preservation of prime-subcontractor rights. Except as provided in paragraph (i) of this clause, this clause shall not limit or impair any contractual, administrative, or judicial remedies otherwise available to the Contractor or a subcontractor in the event of a dispute involving late payment or nonpayment by the Contractor or deficient subcontract performance or nonperformance by a subcontractor.

(k) Non-recourse for prime contractor interest penalty. The Contractor's obligation to pay an interest penalty to a subcontractor pursuant to the clauses included in a subcontract under paragraph (c) of this clause shall not be construed to be an obligation of the United States for such interest penalty. A cost-reimbursement claim may not include any amount for reimbursement of such interest penalty.

## 52.236-2 DIFFERING SITE CONDITIONS (APR 1984)

As prescribed in 36.502, insert the following clause in solicitations and contracts when a fixed-price construction contract or a fixed-price dismantling, demolition, or removal of improvements contract is contemplated and the contract amount is expected to exceed the small purchase limitation. The Contracting Officer may insert the clause in solicitations and contracts when a fixed-price construction or a fixed-price contract for dismantling, demolition, or removal of improvements is contemplated and the contract amount is expected to be within the small purchase limitation.

(a) The Contractor shall promptly, and before the conditions are disturbed, give a written notice to the Contracting Officer of

(1) subsurface or latent physical conditions at the site which differ materially from those indicated in this contract, or

(2) unknown physical conditions at the site, of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the contract.

(b) The Contracting Officer shall investigate the site conditions promptly after receiving the notice. If the conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performing any part of the work under this contract, whether or not changed as a result of the conditions, an equitable adjustment shall be made under this clause and the contract modified in writing accordingly.

(c) No request by the Contractor for an equitable adjustment to the contract under this clause shall be allowed, unless the Contractor has given the written notice required; provided, that the time prescribed in (a) above for giving written notice may be extended by the Contracting Officer.

(d) No request by the Contractor for an equitable adjustment to the contract for differing site conditions shall be allowed if made after final payment under this contract.

#### 52.236-7 PERMITS AND RESPONSIBILITIES (NOV 1991)

The Contractor shall, without additional expense to the Government, be responsible for obtaining any necessary licenses and permits, and for complying with any Federal, State, and municipal laws, codes, and regulations applicable to the performance of the work. The Contractor shall also be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire work, except for any completed unit of work which may have been accepted under the contract.

#### 52.236-9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS (APR 1984)

(a) The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

(b) The Contractor shall protect from damage all existing improvements and utilities

(1) at or near the work site, and

(2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

#### 52.243-4 CHANGES (AUG 1987)

(a) The Contracting Officer may, at any time, without notice to the sureties, if any, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract, including changes --

- (1) In the specifications (including drawings and designs);
- (2) In the method or manner of performance of the work;
- (3) In the Government-furnished facilities, equipment, materials, services, or site; or
- (4) Directing acceleration in the performance of the work.

(b) Any other written or oral order (which, as used in this paragraph (b), includes direction, instruction, interpretation, or determination) from the Contracting Officer that causes a change shall be treated as a change order under this clause; provided, that the Contractor gives the Contracting Officer written notice stating

- (1) the date, circumstances, and source of the order and
- (2) that the Contractor regards the order as a change order.

(c) Except as provided in this clause, no order, statement, or conduct of the Contracting Officer shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment.

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for, the performance of any part of the work under this contract, whether or not changed by any such order, the Contracting Officer shall make an equitable adjustment and modify the contract in writing. However, except for an adjustment based on defective specifications, no adjustment for any change under paragraph (b) of this clause shall be made for any costs incurred more than 20 days before the Contractor gives written notice as required. In the case of defective specifications for which the Government is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with the defective specifications.

(e) The Contractor must assert its right to an adjustment under this clause within 30 days after

(1) receipt of a written change order under paragraph (a) of this clause or (2) the furnishing of a written notice under paragraph (b) of this clause, by submitting to the Contracting Officer a written statement describing the general nature and amount of the proposal, unless this period is extended by the Government. The statement of proposal for adjustment may be included in the notice under paragraph (b) above.

(f) No proposal by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this contract.

#### 52.252-2 CLAUSES INCORPORATED BY REFERENCE (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es):

<http://www.arnet.gov/far/>  
<http://www.acq.osd.mil/dp/dars/dfars/dfars.html>



## SECTION 00800 Special Contract Requirements

## CLAUSES INCORPORATED BY REFERENCE:

52.246-21	Warranty of Construction	MAR 1994
252.225-7014	Preference For Domestic Specialty Metals	MAR 1998
252.225-7030	Restriction On Acquisition Of Carbon, Alloy, And Armor Steel Plate	OCT 1992

## CLAUSES INCORPORATED BY FULL TEXT

## 52.211-10 COMMENCEMENT, PROSECUTION, AND COMPLETION OF WORK (APR 1984)

The Contractor shall be required to (a) commence work under this contract within 10 calendar days after the date the Contractor receives the notice to proceed, (b) prosecute the work diligently, and (c) complete the entire work ready for use not later than 700 calendar days after the contractor receives the notice to proceed. The time stated for completion shall include final cleanup of the premises.

(End of clause)

## 52.211-12 LIQUIDATED DAMAGES--CONSTRUCTION (SEP 2000)

(a) If the Contractor fails to complete the work within the time specified in the contract, the Contractor shall pay liquidated damages to the Government in the amount of \$2000.00 for each calendar day of delay until the work is completed or accepted.

(b) If the Government terminates the Contractor's right to proceed, liquidated damages will continue to accrue until the work is completed. These liquidated damages are in addition to excess costs of repurchase under the Termination clause.

(End of clause)

52.231-5000 EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE  
MAR 1995)--EFARS

(a) This clause does not apply to terminations. See 52.249-5000, Basis for Settlement of Proposals and FAR Part 49.

(b) Allowable cost for construction and marine plant and equipment in sound workable condition owned or controlled and furnished by a contractor or subcontractor at any tier shall be based on actual cost data for each piece of equipment or groups of similar serial and series for which the Government can determine both ownership and operating costs from the contractor's accounting records. When both ownership and operating costs cannot be determined for any piece of equipment or groups of similar serial or series equipment from the contractor's accounting records, costs for that equipment shall be based upon the applicable provisions of EP 1110-1-8, Construction Equipment Ownership and Operating Expense Schedule, Region V. Working conditions shall be considered to be average for determining equipment rates using the schedule unless specified otherwise by the contracting officer. For equipment not included in the schedule, rates for comparable pieces of equipment may be used or a rate may be developed using the formula provided in the schedule. For forward pricing, the schedule in

effect at the time of negotiations shall apply. For retroactive pricing, the schedule in effect at the time the work was performed shall apply.

(c) Equipment rental costs are allowable, subject to the provisions of FAR 31.105(d)(ii) and FAR 31.205-36. Rates for equipment rented from an organization under common control, lease-purchase arrangements, and sale-leaseback arrangements, will be determined using the schedule, except that actual rates will be used for equipment leased from an organization under common control that has an established practice of leasing the same or similar equipment to unaffiliated lessees.

(d) When actual equipment costs are proposed and the total amount of the pricing action exceeds the small purchase threshold, the contracting officer shall request the contractor to submit either certified cost or pricing data, or partial/limited data, as appropriate. The data shall be submitted on Standard Form 1411, Contract Pricing Proposal Cover Sheet.

(End of clause)

#### 52.232-5000 PAYMENT FOR MATERIALS DELIVERED OFF-SITE (MAR 1995)--EFARS

(a) Pursuant to FAR clause 52.232-5, Payments Under Fixed Priced Construction Contracts, materials delivered to the contractor at locations other than the site of the work may be taken into consideration in making payments if included in payment estimates and if all the conditions of the General Provisions are fulfilled. Payment for items delivered to locations other than the work site will be limited to: (1) materials required by the technical provisions; or (3) materials that have been fabricated to the point where they are identifiable to an item of work required under this contract.

(b) Such payment will be made only after receipt of paid or receipted invoices or invoices with canceled check showing title to the items in the prime contractor and including the value of material and labor incorporated into the item. In addition to petroleum products, payment for materials delivered off-site is limited to the type and quantity of materials approved by the Contracting Officer prior to commencement of construction.

(End of clause)

#### 52.236-1 PERFORMANCE OF WORK BY THE CONTRACTOR (APR 1984)

The Contractor shall perform on the site, and with its own organization, work equivalent to at least twenty (20%) percent of the total amount of work to be performed under the contract. This percentage may be reduced by a supplemental agreement to this contract if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the Government.

#### 52.236-4 PHYSICAL DATA (APR 1984)

Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

(a) The indications of physical conditions on the drawings and in the specifications are the result of site investigations

(b) Weather conditions: Each offeror should satisfy himself before submitting his proposal as to hazards likely to arise from weather conditions. Complete weather records and reports may be obtained from the local national Weather Service Office.

(End of clause)

#### 52.236-14 AVAILABILITY AND USE OF UTILITY SERVICES (APR 1984)

(a) The Government shall make all reasonably required amounts of utilities available to the Contractor from existing

outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the Government or, where the utility is produced by the Government, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

(b) The Contractor, at its expense and in a workmanlike manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

#### 252.236-7001 CONTRACT DRAWINGS, MAPS, AND SPECIFICATIONS (AUG 2000)

(a) The Government will provide to the Contractor, without charge, one set of contract drawings and specifications, except publications incorporated into the technical provisions by reference, in electronic or paper media as chosen by the Contracting Officer.

(b) The Contractor shall--

- (1) Check all drawings furnished immediately upon receipt;
- (2) Compare all drawings and verify the figures before laying out the work;
- (3) Promptly notify the Contracting Officer of any discrepancies;
- (4) Be responsible for any errors that might have been avoided by complying with this paragraph (b); and
- (5) Reproduce and print contract drawings and specifications as needed.

(c) In general--

- (1) Large-scale drawings shall govern small-scale drawings; and
- (2) The Contractor shall follow figures marked on drawings in preference to scale measurements.

(d) Omissions from the drawings or specifications or the misdescription of details of work that are manifestly necessary to carry out the intent of the drawings and specifications, or that are customarily performed, shall not relieve the Contractor from performing such omitted or misdescribed details of the work. The Contractor shall perform such details as if fully and correctly set forth and described in the drawings and specifications.

(e) The work shall conform to the specifications and the contract drawings identified on the index of drawings, all of which form a part of these specifications and are available in the office of the Kansas City District, Corps of Engineers, 760 Federal Building, 601 E. 12<sup>th</sup> Street, Kansas City, MO 64106.

(End of clause)

SECTION 00810

WAGE RATES

1. MO010001, dated 07/06/01, 7 mods.
2. MO010002, date 07/06/01, 5 mods.

GENERAL DECISION MO010001 07/06/01 MO1  
General Decision Number MO010001

Superseded General Decision No. MO000001

State: Missouri

Construction Type:

HEAVY

HIGHWAY

County(ies):

STATEWIDE

HEAVY AND HIGHWAY CONSTRUCTION PROJECTS

Modification Number	Publication Date
0	03/02/2001
1	03/09/2001
2	04/13/2001
3	05/04/2001
4	05/11/2001
5	06/01/2001
6	06/15/2001
7	07/06/2001

COUNTY(ies):

STATEWIDE

CARP0007M 04/01/1999

	Rates	Fringes
CASS (Richards-Gebauer AFB ONLY), CLAY, JACKSON, PLATTE AND RAY COUNTIES		

CARPENTERS & PILEDRIVERS	22.95	5.95
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CARP0008C 05/01/1999

	Rates	Fringes
ST. LOUIS COUNTY AND CITY		

CARPENTERS	26.49	5.69
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CARP0011A 05/01/2000

	Rates	Fringes
CARPENTERS & PILEDRIVERS:		

JEFFERSON AND ST. CHARLES COUNTIES	26.29	5.40
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FRANKLIN COUNTY	23.78	5.40
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WARREN COUNTY	23.78	5.40
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LINCOLN COUNTY	23.39	5.40
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PIKE, ST. FRANCOIS AND WASHINGTON COUNTIES	22.44	5.40
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BUCHANAN, CASS, CLINTON, JOHNSON AND LAFAYETTE COUNTIES	21.88	5.76
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ATCHISON, ANDREW, BATES, CALDWELL,		
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CARROLL, DAVIESS, DEKALB, GENTRY, GRUNDY, HARRISON, HENRY, HOLT, LIVINGSTON, MERCER, NODAWAY, ST. CLAIR, SALINE AND WORTH COUNTIES	21.23	5.76
BARRY, BARTON, CAMDEN, CEDAR, CHRISTIAN, DADE, DALLAS, DOUGLAS, GREENE, HICKORY, JASPER, LACLEDE, LAWRENCE, MCDONALD, NEWTON, OZARK, POLK, STONE, TANEY, VERNON, WEBSTER AND WRIGHT COUNTIES	20.88	5.76
CRAWFORD, DENT, GASCONADE, IRON, MADISON, MARIES, MONTGOMERY, PHELPS, PULASKI, REYNOLDS, SHANNON, AND TEXAS COUNTIES	21.73	5.40
AUDRAIN (East of Hwy.19), RALLS, MARION, LEWIS, CLARK AND SCOTLAND COUNTIES	21.88	5.40
BOONE, COOPER, AND HOWARD COUNTIES	20.48	4.80
BENTON, MORGAN AND PETTIS COUNTIES	19.18	4.80
CALLAWAY, COLE, MILLER, MONITEAU, AND OSAGE COUNTIES	20.48	4.80
ADAIR, KNOX, PUTNAM, SCHUYLER, AND SULLIVAN COUNTIES	20.48	4.80
CHARITON, LINN, MACON, MONROE, RANDOLPH, AND SHELBY COUNTIES	20.48	4.80
BOLLINGER, BUTLER, CAPE GIRARDEAU, DUNKLIN, MISSISSIPPI, NEW MADRID, PEMISCOT, PERRY, STE. GENEVIEVE, SCOTT, STODDARD AND WAYNE COUNTIES	22.46	4.72
CARTER, HOWELL, OREGON AND RIPLEY COUNTIES	21.54	4.72

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ELEC0001B 06/01/2000

	Rates	Fringes
BOLLINGER, BUTLER, CAPE GIRARDEAU, CARTER, DUNKLIN, FRANKLIN, IRON, JEFFERSON, LINCOLN, MADISON, MISSISSIPPI, NEW MADRID, PEMISCOT, PERRY, REYNOLDS, RIPLEY, ST. CHARLES, ST. FRANCOIS, ST. LOUIS (City and County), STE. GENEVIEVE, SCOTT, STODDARD, WARREN, WASHINGTON AND WAYNE COUNTIES		

ELECTRICIANS	26.65	14.21
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ELEC0002D 09/03/2000

	Rates	Fringes
ADAIR, AUDRAIN, BOONE, CALLAWAY, CAMDEN, CARTER, CHARITON, CLARK, COLE, COOPER, CRAWFORD, DENT, FRANKLIN, GASCONADE, HOWARD, HOWELL, IRON, JEFFERSON, KNOX, LEWIS, LINCON, LINN, MACON, MARIES, MARION, MILLER, MONITEAU, MONROE, MONTGOMERY, MORGAN, OREGON, OSAGE, PERRY, PHELPS, PIKE, PULASKI, PUTNAM, RALLS, RANDOLPH, REYNOLDS, RIPLEY, ST. CHARLES, ST. FRANCOIS, ST. LOUIS (City and County), STE. GENEVIEVE, SCHUYLER, SCOTLAND, SHANNON, SHELBY, SULLIVAN, TEXAS, WARREN AND WASHINGTON		

COUNTIES.

LINE CONSTRUCTION:

Lineman & Cable Splicer	26.42	42% + 2.10
Groundman Equipment Operator	23.65	42% + 2.10
Groundman Winch Driver	19.44	42% + 2.10
Groundman, Groundman Driver	18.72	42% + 2.10

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ELEC0053F 08/27/2000

	Rates	Fringes
BATES, BENTON, CARROLL, CASS, CLAY, HENRY, JACKSON, JOHNSON, LAFAYETTE, PETTIS, PLATTE, RAY, AND SALINE COUNTIES.		

LINE CONSTRUCTION:

Lineman	27.80	9.99
Lineman Operator	25.97	9.46
Groundman Powderman	19.45	7.59
Groundman	18.49	7.31

ANDREW, ATCHINSON, BARRY, BARTON, BUCHANAN, CALDWELL, CEDAR,  
CHRISTIAN, CLINTON, DADE, DALLAS, DAVIESS, DE KALB, DOUGLAS,  
GENTRY, GREENE, GRUNDY, HARRISON, HICKORY, HOLT, JASPER, LACLEDE,  
LAWRENCE, LIVINGSTON, McDONALD, MERCER, NEWTON, NODAWAY, OZARK,  
POLK, ST. CLAIR, STONE, TANEY, VERNON, WEBSTER, WORTH, AND  
WRIGHT COUNTIES.

LINE CONSTRUCTION:

Lineman	26.75	9.69
Lineman Operator	25.41	9.30
Groundman Powderman	18.69	7.37
Groundman	17.30	6.98

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ELEC0095C 06/01/2001

	Rates	Fringes
BARRY, BARTON, CEDAR, CRAWFORD, DADE, JASPER, LAWRENCE, MCDONALD, NEWTON, ST CLAIR, AND VERNON COUNTIES		

ELECTRICIANS:

Electricians	20.51	5.68
Cable Splicers	20.86	5.68

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ELEC0124I 09/04/2000

	Rates	Fringes
BATES, BENTON, CARROLL, CASS, CLAY, COOPER, HENRY, JACKSON, JOHNSON, LAFAYETTE, MORGAN, PETTIS, PLATTE, RAY AND SALINE COUNTIES:		

ELECTRICIANS	27.01	11.30
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ELEC0257C 03/01/1999

	Rates	Fringes
AUDRAIN (Except, Cuivre Township), BOONE, CALLAWAY, CAMDEN, CHARITON, COLE, CRAWFORD, DENT, GASCONADE, HOWARD, MARIES,		

MILLER, MONITEAU, OSAGE, PHELPS AND RANDOLPH COUNTIES:

Electricians	20.95	8.88
Cable Splicers	21.95	8.88

ELEC0350B 12/01/2000

	Rates	Fringes
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ADAIR, AUDRAIN (East of Highway 19), CLARK, KNOX, LEWIS, LINN,  
MACON, MARION, MONROE, MONTGOMERY, PIKE, PUTNAM, RALLS, SCHUYLER,  
SCOTLAND, SHELBY AND SULLIVAN COUNTIES

ELECTRICIANS	24.06	7.44
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ELEC0453D 09/01/2000

	Rates	Fringes
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CHRISTIAN, DALLAS, DOUGLAS, GREENE, HICKORY, OREGON, OZARK,  
SHANNON, TEXAS, WEBSTER AND WRIGHT COUNTIES

ELECTRICIANS	20.60	4.37+10%
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PULASKI COUNTY

ELECTRICIANS	21.64	4.37+10%
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HOWELL, LACLEDE, POLK, STONE AND TANEY COUNTIES

ELECTRICIANS	14.20	3.97+10%
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ELEC0545D 06/01/2001

	Rates	Fringes
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ANDREW, BUCHANAN, CLINTON, DEKALB, ATCHISON, HOLT, MERCER,  
GENTRY, HARRISON, DAVIESS, GRUNDY, WORTH, LIVINGSTON, NODAWAY,  
AND CALDWELL COUNTIES

ELECTRICIANS	25.06	8.29
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ELEC0702D 09/04/1995

	Rates	Fringes
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BOLLINGER, BUTLER, CAPE GIRARDEAU, DUNKLIN, MADISON, MISSISSIPPI,  
NEW MADRID, PEMISCOT, SCOTT, STODDARD AND WAYNE COUNTIES

LINE CONSTRUCTION:

Lineman	25.50	17%+2.00
Groundman Equipment Operator (all crawler type equipment D-4 and larger)	21.87	17%+2.00
Groundman - Class A	15.45	17%+2.00

ENGI0016A 05/01/2000

	Rates	Fringes
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BARRY, BARTON, CAMDEN, CEDAR, CHRISTIAN, DADE, DALLAS, DOUGLAS,



GREENE, JASPER, LAWRENCE, HICKORY, LACLEDE, MCDONALD, NEWTON,  
OZARK, POLK, ST. CLAIR, STONE, TANEY, VERNON, WEBSTER AND  
WRIGHT COUNTIES

POWER EQUIPMENT OPERATORS

GROUP 1	19.72	5.45
GROUP 2	19.37	5.45
GROUP 3	19.17	5.45
GROUP 4	17.12	5.45

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Asphalt finishing machine & trench widening spreader;  
asphalt plant console operator; autograder; automatic slipform  
paver; backhoe; blade operator - all types; boat operator -

tow; boilers-2; central mix concrete plant operator; clamshell  
operator; concrete mixer paver; crane operator; derrick or  
derrick trucks; ditching machine; dozer operator; dragline  
operator; dredge booster pump; dredge engineman; dredge operator;  
drill cat with compressor mounted on cat; drilling or boring  
machine rotary self-propelled; highloader; hoisting engine - 2  
active drums; launch hammer wheel; locomotive operator; -  
standard guage; mechanic and welders; mucking machine; off-road  
trucks; piledriver operator; pitman crane operator; push cat  
operator; quad trac; scoop operator - all types; shovel operator;  
sideboom cats; skimmer scoop operators; trenching machine  
operator; truck crane.

GROUP 2: A-frame; asphalt hot-mix silo; asphalt plant fireman  
(drum or boiler); asphalt plant man; asphalt plant man; asphalt  
plant mixer operator; asphalt roller operator; backfiller  
operator; barber-green loader; boat operator (bridges and dams);  
chip spreader; concrete mixer operator - skip loader; concrete  
plant operator; concrete pump operator; crusher operator; dredge  
oiler; elevating grader operator; fork lift; greaser-fleet;  
hoisting engine - 1; locomotive operator - narrow gauge; multiple  
compactor; pavement breaker; powerbroom - self-propelled; power  
shield; rooter; side discharge concrete spreader; slip form  
finishing machine; stumpcutter machine; throttle man; tractor  
operator (over 50 h.p.); winch truck.

GROUP 3: Boilers - 1; chip spreader (front man); churn drill  
operator; clef plane operator; concrete saw operator (self-  
propelled); curb finishing machine; distributor operator;  
finishing machine operator; flex plane operator; float operator;  
form grader operator; pugmill operator; roller operator, other  
than high type asphalt; screening & washing plant operator;  
siphons & jets; sub-grading machine operator; spreader box  
operator, self-propelled (not asphalt); tank car heater operator  
(combination boiler & booster); tractor operator (50 h.p. or  
less); Umac, Ulric or similar spreader; vibrating machine  
operator, not hand;

GROUP 4: Grade checker; Oiler; Oiler-Driver

HOURLY PREMIUMS:



boat operator; truck crane; wood and log chippers (all types).

GROUP 2: A-frame truck operator; articulated dump truck; back filler operator; boilers (1); chip spreader; churn drill operator; compressor; concrete mixer operator, skip loader; concrete saws (self-propelled); conveyor operator; crusher operator; distributor operator; elevating grader operator; farm tractor (all attachments); fireman rig; float operator; form grade operator; hoisting engine (one drum); maintenance operator; multiple compactor; pavement breaker, self-propelled hydra-hammer (or similar type); paymill operator; power shield; pumps; roller

operator (with or without blades); screening and washing plant; self-propelled street broom or sweeper; siphons and jets; straw blower; stump cutting machine; siphons and jets; tank car heater operator (combination boiler and booster); welding machine; vibrating machine operator (not hand held); welding machine.  
GROUP 3: Oiler; oiler driver; mechanic.

#### HOURLY PREMIUMS:

THE FOLLOWING CLASSIFICATIONS SHALL RECEIVE (\$ .25) ABOVE

GROUP 1 RATE: Dragline operator - 3 yds. & over; shovel 3 yds. & over; clamshell 3 yds. & over; Crane, rigs or piledrivers, 100' of boom or over (incl. jib.), hoist - each additional active drum over 2 drums

THE FOLLOWING CLASSIFICATIONS SHALL RECEIVE (\$ .50) ABOVE

GROUP 1 RATE: Tandem scoop operator; crane, rigs or piledrivers 150' to 200' of boom (incl. jib.)

THE FOLLOWING CLASSIFICATIONS SHALL RECEIVE (\$ .75) ABOVE

GROUP 1 RATE: Crane rigs, or piledrivers 200 ft. of boom or over (including jib.)

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ENGI0101E 04/01/2001

	Rates	Fringes
CASS (Richards-Gebaur Air Force Base ONLY), CLAY, JACKSON, PLATTE AND RAY COUNTIES		

#### POWER EQUIPMENT OPERATORS:

GROUP 1	23.04	8.22
GROUP 2	22.00	8.22
GROUP 3	17.53	8.22
GROUP 4	20.88	8.22

#### POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Asphalt roller operator, finish; asphalt paver and spreader; asphalt plant operator; auto grader or trimmer or sub-grader; backhoe; blade operator (all types); boilers-2; booster pump on dredge; boring machine (truck or crane mounted); bulldozer operator; clamshell operator; concrete cleaning decontamination machine operator; concrete mixer paver; concrete plant operator; concrete pump operator; crane operator; derrick or derrick trucks; ditching machine; dragline operator; dredge engineman; dredge operator; drillcat with compressor

mounted (self-contained) or similar type self propelled rotary drill (not air tract); drilling or boring machine (rotary - self-propelled); finishing machine operator; greaser; heavy equipment robotics operator/mechanic; horizontal directional drill operator; horizontal directional drill locator; loader-forklift - skid loader (all types); hoisting engineer (2 active drums); locomotive operator (standard guage); master environmental maintenance mechanic; mechanics and welders (field and plants); mucking machine operator; piledrive operator; pitman crane or boom truck (all types); push cat;

quad-track; scraper operators (all types); shovel operator; side discharge spreader; sideboom cats; skimmer scoop operator; slip-form paver (CMI, REX, Gomaco or equal); la tourneau rooter (all tiller types); tow boat operator; truck crane; ultra high perssure waterjet cutting tool system operator/mechanic; vacuum blasting machine operator/mechanic; wood and log chippers (all types)

GROUP 2: "A" Frame truck operator; articulated dump truck; back filler operator; boilers (1); chip spreader; churn drill operator; concrete mixer operator, skip loader; concrete saws (self-propelled); conveyor operator; crusher operator; distributor operator; elevating grader operator; farm tractor (all attachments); fireman rig; float operator; form grader operator; hoisting engine (1 drum); maintenance operator; multiple compactor; pavement breaker, self-propelled hydra-hammer (or similar type); power shield; paymill operator; pumps; siphons and jets; stump cutting machine; tank car heater operator (combination boiler and booster); compressor; roller operator (with or without blades); screening and washing plant; self-propelled street broom or sweeper; straw blower; tank car heater operator (combination boiler and booster); vibrating machine operator (not hand held)

GROUP 3: Oilers

GROUP 4: Oiler Driver (All Types)

FOOTNOTE:

HOURLY PREMIUMS

FOLLOWING CLASSIFICATIONS SHALL RECEIVE (\$.25) ABOVE GROUP 1 RATE: Clamshells - 3 yd. capacity or over; Cranes or rigs, 80 ft. of boom or over (including jib); Draglines, 3 yd. capacity or over; Piledrivers 80 ft. of boom or over (including jib); Shovels & backhoes, 3 yd. capacity or over.

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ENGI0513D 05/01/2000

Rates Fringes  
FRANKLIN, JEFFERSON, LINCOLN, ST CHARLES, AND WARREN COUNTIES

POWER EQUIPMENT OPERATORS:

GROUP 1	23.92	10.71
GROUP 2	22.62	10.71
GROUP 3	19.62	10.71
GROUP 4	22.17	10.71

## POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Backhoe, Cable; Backhoe, Hydraulic (2 cu yds bucket and under regardless of attachment, one oiler for 2 or 3, two oilers for 4 through 6); Backhoe, Hydraulic over 2 cu yds; Cableway; Crane, Crawler or Truck; Crane, Hydraulic - Truck or Cruiser mounted, 16 tons and over; Crane, Locomotive; crane with boom including jib over 100 ft from pin to pin; Crane using rock

socket tool; Derrick, Steam; Derrick Car and Derrick Boat; Dragline, 7 cu yds and over; Dredge; Gradall, Crawler or tire mounted; Locomotive, Gas, Steam & other powers; Pile Driver, Land or Floating; Scoop, Skimmer; Shovel, Power (Electric, Gas, Steam or other powers); Shovel, Power (7 cu yds and over); Switch Boat; Whirley; Air Tugger with air compressor; Anchor Placing Barge; Asphalt Spreader; Athey Force Feeder Loader, self-propelled; Backfilling Machine; Boat Operator - Push Boat or Tow Boat (job site); Boiler, High Pressure Breaking in Period; Boom Truck, Placing or Erecting; Boring Machine, Footing Foundation; Bullfloat; Cherry Picker; Combination Concrete Hoist and Mixer (such as Mixermobile); Compressor, Two 125 CFM and under; Compressor, Two through Four over 125 CFM; Compressor when operator runs throttle; Concrete Breaker (Truck or Tractor mounted); Concrete Pump (such as Pumpcrete machine); Concrete Saw (self-propelled); Concrete Spreader; Conveyor, Large (not self-propelled) hoisting or moving brick and concrete into, or into and on floor level, one or both; Crane, Climbing (such as Linden); Crane, Hydraulic - Rough Terrain, self-propelled; Crane, Hydraulic - Truck or Cruiser mounted - under 16 tons; Drilling machine - Self-powered, used for earth or rock drilling or boring (wagon drills and any hand drills obtaining power from other sources including concrete breakers, jackhammers and Barco equipment no engineer required); Elevating Grader; Engine Man, Dredge; Excavator or Powerbelt Machine; Finishing Machine, self-propelled oscillating screed; Forklift; Generators, Two through Six 30 KW or over; Grader, Road with power blade; Greaser; Highlift; Hoist, Concrete and Brick (Brick cages or concrete skips operating or on tower, Towermobile, or similar equipment); Hoist, Three or more drums in use; Hoist, Stack; Hydro-Hammer; Lad-A-Vator, hoisting brick or concrete; Loading Machine such as Barber-Greene; Mechanic on job site

GROUP 2: Air Tugger with plant air; Boiler (for power or heating shell of building or temporary enclosures in connection with construction work); Boiler, Temporary; Compressor, One over 125 CFM; Compressor, truck mounted; Conveyor, Large (not self-propelled); Conveyor, Large (not self-propelled) moving brick and concrete (distributing) on floor level; Curb Finishing Machine; Ditch Paving Machine; Elevator (outside); Endless Chain Hoist; Fireman (as required); Form Grader; Hoist, One Drum regardless of size (except brick or concrete); Lad-A-Vator, other hoisting; Manlift; Mixer, Asphalt, over 8 cu ft capacity; Mixer, one bag capacity or less; Mixer, without side loader, two bag capacity or more; Mixer, with side loader, regardless of size, not Paver; Mud Jack (where mud jack is used in conjunction with an air compressor, operator shall be paid \$ .55 per hour in

addition to his basic hourly rate for covering both operations);  
 Pug Mill operator; Pump, Sump - self powered, automatic  
 controlled over 2"; Scissor Lift (used for hoisting); Skid Steer  
 Loader; Sweeper, Street; Tractor, small wheel type 50 HP and  
 under with grader blade and similar equipment; Welding Machine,  
 One over 400 amp; Winch, operating from truck

GROUP 3: Boat operator - outboard motor, job site; Conveyors  
 (such as Con-Vay-It) regardless of how used; Elevator (inside);

Heater operator, 2 through 6; Sweeper, Floor

GROUP 4: Crane type

#### HOURLY PREMIUMS:

Backhoe, Hydraulic 2 cu yds or less without oiler - \$2.00;  
 Certified Crane Operator - \$1.50; Certified Hazardous Material  
 Operator \$1.50; Crane, climbing (such as Linden) - \$.50; Crane,  
 Pile Driving and Extracting - \$ .50 Crane with boom (including  
 job) over 100 ft from pin to pin - add \$.01 per foot to maximum  
 of \$4.00); Crane, using rock socket tool - \$ .50; Derrick,  
 diesel, gas or electric hoisting material and erecting steel  
 (150 ft or more above ground) - \$ .50; Dragline, 7 cu yds and  
 over - \$ .50; Hoist, Three or more drums in use - \$ .50; Scoop,  
 Tandem - \$.50; Shovel, Power - 7 cu yds and over - \$ .50;  
 Tractor, Tandem Crawler - \$ .50; Tunnel, man assigned to work  
 in tunnel or tunnel shaft - \$ .50; Wrecking, when machines are  
 working on second floor or higher - \$ .50

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 ENGI0513G 05/01/2001

	Rates	Fringes
ADAIR, AUDRAIN, BOLLINGER, BOONE, BUTLER, CALLAWAY, CAPE		
GIRARDEAU, CARTER, CLARK, COLE, CRAWFORD, DENT, DUNKLIN,		
GASCONADE, HOWELL, IRON, KNOX, LEWIS, MACON, MADISON, MARIES,		
MARION, MILLER, MISSISSIPPI, MONITEAU, MONROE, MONTGOMERY,		
MORGAN, NEW MADRID, OREGON, OSAGE, PEMISCOT, PERRY, PHELPS, PIKE,		
PULASKI, PUTNAM, RALLS, RANDOLPH, REYNOLDS, RIPLEY, ST. FRANCOIS,		
STE. GENEVIEVE, SCHUYLER, SCOTLAND, SCOTT, SHANNON, SHELBY,		
STODDARD, TEXAS, WASHINGTON, AND WAYNE COUNTIES		

#### POWER EQUIPMENT OPERATORS

GROUP 1	20.75	11.61
GROUP 2	20.40	11.61
GROUP 3	20.20	11.61
GROUP 4	16.55	11.61

#### POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Asphalt finishing machine & trench widening spreader,  
 asphalt plant console operator; autograder; automatic slipform  
 paver; back hoe; blade operator - all types; boat operator tow;  
 boiler two; central mix concrete plant operator; clam shell  
 operator; concrete mixer paver; crane operator; derrick or  
 derrick trucks; ditching machine; dozer operator; dragline  
 operator; dredge booster pump; dredge engineman; dredge operator;  
 drill cat with compressor mounted on cat; drilling or boring

machine rotary self-propelled; highloader; hoisting engine 2  
active drums; launchhammer wheel; locomotive operator standrad  
guage; mechanics and welders; mucking machine; piledriver  
operator; pitman crane operator; push cat operator; quad-trac;  
scoop operator; sideboom cats; skimmer scoop operator; trenching  
machine operator; truck crane, shovel operator.

GROUP 2: A-Frame; asphalt hot-mix silo; asphalt roller operator

asphalt plant fireman (drum or boiler); asphalt plant man;  
asphalt plant mixer operator; backfiller operator; barber-greene  
loader; boat operator (bridge & dams); chip spreader; concrete  
mixer operator skip loader; concrete plant operator; concrete  
pump operator; dredge oiler; elevating graded operator; fork  
lift; grease fleet; hoisting engine one; locomotive operator  
narrow guage; multiple compactor; pavement breaker; powerbroom  
self-propelled; power shield; rooter; slip-form finishing  
machine; stumpcutter machine; side discharge concrete spreader;  
throttleman; tractor operator (over 50 hp); winch truck; asphalt  
roller operator; crusher operator.

GROUP 3: Spreader box operator, self-propelled not asphalt;  
tractor operator (50 h.p. or less); boilers one; chip spreader  
(front man); churn drill operator; compressor over 105 CFM 2-3  
pumps 4" & over; 2-3 light plant 7.5 KWA or any combination  
thereof; clef plane operator; compressor maintenance operator 2  
or 3; concrete saw operator (self-propelled); curb finishing  
mancine; distributor operator; finishing machine operator; flex  
plane operator; float operator; form grader operator; pugmill  
operator; riller operator other than high type asphalt; screening  
& washing plant operator; siphons & jets; subgrading machine  
operator; tank car heater (combination boiler & booster); ulmac,  
ulric or similar spreader; vibrating machine operator;  
hydrobroom.

GROUP 4: Oiler; grout machine; oiler driver; compressor over 105  
CFM one; conveyor operator one; maintenance operator; pump 4" &  
over one.

#### FOOTNOTE:

##### HOURLY PREMIUMS

Backhoe hydraulic, 2 cu. yds. or under without oiler - \$2.00  
Certified Crane Operator - \$1.50; Certified Hazardous Material  
Operator \$1.50; Crane, climbing (such as Linden) - \$0.50;  
Crane, pile driving and extracting - \$0.50; Crane, with boom  
(including jib) over 100' from pin to pin add \$0.01 per foot  
to maximum of \$4.00; Crane, using rock socket tool - \$0.50;  
Derrick, diesel, gas or electric, hoisting material and  
erecting steel (150' or more above the ground) - \$0.50;  
Dragline, 7 cu. yds. and over - \$0.50; Hoist, three or more  
drums in use - \$0.50; Scoop, Tandem - \$0.50; Shovel, power -  
7 cu. yds. or more - \$0.50; Tractor, tandem crawler - \$0.50;  
Tunnel, man assigned to work in tunnel or tunnel shaft -  
\$0.50; Wrecking, when machine is working on second floor or  
higher - \$0.50;

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	Rates	Fringes
ST. LOUIS CITY AND COUNTY		
POWER EQUIPMENT OPERATORS:		
GROUP 1	24.32	11.63
GROUP 2	24.32	11.63
GROUP 3	22.42	11.63
GROUP 4	19.42	11.63
GROUP 5	18.96	11.63

POWER EQUIPMENT OPERATORS CLASSIFICATIONS

GROUP 1: Backhoe, cable or hydraulic; cableway; crane, crawler or truck; crane, hydraulic-truck or cruiser mounted 16 tons & over; crane locomotive; derrick, steam; derrick car & derrick boat; dragline; dredge; gradall, crawler or tire mounted; locomotive, gas, steam & other powers; pile driver, land or floating; scoop, skimmer; shovel, power (steam, gas, electric, or other powers); switch boat; whirley.

GROUP 2: Air tugger w/air compressor; anchor-placing barge; asphalt spreader; atthey force feeder loader (self-propelled); backfilling machine; backhoe-loader; boat operator-push boat or tow boat (job site); boiler, high pressure breaking in period; boom truck, placing or erecting; boring machine, footing foundation; bull-float; cherry picker; combination concrete hoist & mixer (such as mixer mobile); compressor (when operator runs throttle); concrete breaker (truck or tractor mounted); concrete pump, such as pump-crete machine; concrete saw (self-propelled), concrete spreader; conveyor, large (not self-propelled), hoisting or moving brick and concrete into, or into and on floor level, one or both; crane, hydraulic-rough terrain, self-propelled; crane hydraulic-truck or cruiser mounted-under 16 tons; drilling machines, self-powered use for earth or rock drilling or boring (wagon drills and any hand drills obtaining power from other sources including concrete breakers, jackhammers and barco equipment-no engineer required); elevating grader; engineman, dredge; excavator or powerbelt machine; finishing machine, self-propelled oscillating screed; forklift; grader, road with power blade; highlift; greaser; hoist, stack, hydro-hammer; loading machine (such as barber-greene); machanic, on job site; mixer, pipe wrapping machines; plant asphalt; plant, concrete producing or ready-mix job site; plant heating-job site; plant mixing-job site; plant power, generating-job site; pumps, two through six self-powered over 2"; pumps, electric submersible, two through six, over 4"; quad-track; roller, asphalt, top or sub-grade; scoop, tractor drawn; spreader box; sub-grader; tie tamper; tractor-crawler, or wheel type with or without power unit, power take-offs and attachments regardless of size;



trenching machine; tunnel boring machine; vibrating machine automatic, automatic propelled; welding machines (gasoline or diesel) two through six; well drilling machine

GROUP 3: Conveyor, large (not self-propelled); conveyor, large (not self-propelled) moving brick and concrete

distributing) on floor level; mixer two or more mixers of one bag capacity or less; air tugger w/plant air; boiler, for power or heating on construction projects; boiler, temporary; compressor (mounted on truck; curb finishing machine; ditch paving machine; elevator; endless chain hoist; form grader; hoist, one drum regardless of size; lad-a-vator; manlift; mixer, asphalt, over 8 cu. ft. capacity, without side loader, 2 bag capacity or more; mixer, with side loader, regardless of size; pug mill operator; pump, sump-self-powered, automatic controlled over 2" during use in connection with construction work; sweeper, street; welding machine, one over 400 amp.; winch operating from truck; scissor lift (used for hoisting); tractor, small wheel type 50 h.p. & under with grader blade & similar equipment

GROUP 4: Boat operator-outboard motor (job site); conveyor (such as con-vay-it) regardless of how used; sweeper, floor

GROUP 5: Oiler on dredge and on truck crane.

#### HOURLY PREMIUMS:

Backhoe, hydraulic	
2 cu. yds. or under without oiler	\$2.00
Certified Crane Operator	1.50
Certified Hazardous Material Operator	1.50
Crane, climbing (such as Linden)	.50
Crane, pile driving and extracting	.50
Crane, with boom (including jib) over 100' (from pin to pin) add \$.01 per foot to maximum of	4.00
Crane, using rock socket tool	.50
Derrick, diesel, gas or electric, hoisting material and erecting steel (150' or more above ground)	.50
Dragline, 7 cu. yds. and over	.50
Hoist, three (3) or more drums in use	.50
Scoop, Tandem	.50
Shovel, power - 7 cu. yds. or more	.50
Tractor, tandem crawler	.50
Tunnel, man assigned to work in tunnel or tunnel shaft	.50
Wrecking, when machine is working on second floor or higher	.50

IRON0010M 04/01/2001

BUCHANAN, CASS, CLAY, JACKSON, JOHNSON, LAFAYETTE, PLATTE AND

RAY Counties

IRONWORKERS	22.70	11.63
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ANDREW, ATCHISON, BARTON, BATES, BENTON, CALDWELL, CAMDEN,

CARROLL, CEDER CHARITON, CHRISTIAN, CLINTON, COOPER, DADE,  
DALLAS, DAVIESS, DE KALB, GENTRY, GREENE, GRUNDY, HARRISON,  
HENRY, HICKORY, HOLT, HOWARD, LACLEDE, LINN, LIVINGSTON, MERCER,  
MONITEAU, MORGAN, NODAWAY, PETTIS, POLK, PUTNAM, RANDOLPH, ST.  
CLAIR, SALINE, SULLIVAN, TANEY, VERNON, WEBSTER, WRIGHT and WORTH  
Counties; and portions of ADAIR, BOONE, MACON, MILLER, and  
RANDOLPH Counties

IRONWORKERS	19.70	11.63
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IRON0321C 12/31/2000

Rates	Fringes
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DOUGLAS, HOWELL and OZARK COUNTIES

IRONWORKERS	16.68	7.23
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IRON0396D 08/02/2000

Rates	Fringes
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ST. LOUIS (City and County), ST. CHARLES, JEFFERSON, IRON,  
FRANKLIN, LINCOLN, WARREN, WASHINGTON, ST. FRANCOIS, STE.  
GENEVIEVE, and REYNOLDS Counties; and portions of MADISON, PERRY,  
BOLLINGER, WAYNE, and CARTER Counties

IRONWORKERS	24.34	10.79
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IRON0396I 08/01/2000

Rates	Fringes
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AUDRAIN, CALLAWAY, COLE, CRAWFORD, DENT, GASCONADE, MARIES,  
MONTGOMERY, OSAGE, PHELPS, PIKE, PULASKI, TEXAS, and WRIGHT  
Counties; and portions of CAMDEN, DOUGLAS, HOWELL, MILLER,  
OREGON, BOONE, SHANNON, LACLEDE, MONROE, and RALLS Counties

IRONWORKERS	19.60	10.74
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IRON0577F 06/01/2001

Rates	Fringes
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ADAIR, CLARK, KNOX, LEWIS, MACON, MARION, MONROE, RALLS,  
SCHUYLER, SCOTLAND, AND SHELBY COUNTIES

IRONWORKERS	19.85	9.06
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IRON0584E 06/01/2001

Rates	Fringes
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BARRY, JASPER, LAWRENCE, MCDONALD, NEWTON AND STONE Counties

IRONWORKERS	18.20	7.87
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IRON0782D 05/01/2001

Rates Fringes  
CAPE GIRARDEAU, MISSISSIPPI, NEW MADRID, SCOTT, & STODDARD

Counties; and portions of BOLLINGER, BUTLER, CARTER, DUNKLIN,  
MADISON, PEMISCOT, PERRY, RIPLEY, and WAYNE Counties

IRONWORKERS:

All Major River Work

(Dams, Bridges):

Projects \$20 million

or more

20.65

9.88

All Other Work

19.55

9.11  
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LABO0042C 03/05/2001

Rates Fringes  
ST. LOUIS (City and County)

LABORERS:

Plumber Laborers

22.75

6.65  
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LABO0042H 03/07/2001

Rates Fringes  
ST. LOUIS (City and County)

LABORERS:

Laborers, Flagperson

22.61

6.65

Wrecking

22.49

6.65

Dynamiter, Powderman

23.11

6.65  
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LABO0424B 05/01/2000

Rates Fringes  
FRANKLIN COUNTY

LABORERS

GROUP 1

20.65

5.90

GROUP 2

21.25

5.90

JEFFERSON COUNTY

LABORERS

GROUP 1

20.70

5.90

GROUP 2

21.30

5.90

ADAIR, AUDRAIN, BOLLINGER, BOONE, BUTLER, CALLAWAY, CAPE  
GIRARDEAU, CARTER, CHARITON, CLARK, COLE, COOPER, CRAWFORD, DENT,  
DUNKLIN, GASCONADE, HOWARD, HOWELL, IRON, KNOX, LEWIS, LINN,  
MACON, MADISON, MARIES, MARION, MILLER, MISSISSIPPI, MONITEAU,  
MONROE, NEW MADRID, OREGON, OSAGE, PEMISCOT, PERRY, PHELPS, PIKE,  
PULASKI, PUTNAM, RALLS, RANDOLPH, REYNOLDS, RIPLEY, ST. FRANCOIS,  
STE. GENEVIEVE, SCHUYLER, SCOTLAND, SCOTT, SHANNON, SHELBY,

STODDARD, SULLIVAN, TEXAS, WASHINGTON, AND WAYNE COUNTIES

LABORERS

GROUP 1	19.20	5.90
GROUP 2	19.80	5.90

LINCOLN, MONTGOMERY AND WARREN COUNTIES

LABORERS

GROUP 1	19.45	5.90
GROUP 2	20.05	5.90

LABORERS CLASSIFICATIONS

GROUP 1 - General laborer-flagman, carpenter tenders; salamander Tenders; Dump Man; Ticket Takers; loading trucks under bins, hoppers, and conveyors; track man; cement handler; dump man on earth fill; georgie buggy man; material batch hopper man; spreader on asphalt machine; material mixer man (except on manholes); coffer dams; riprap pavers rock, block or brick; scaffolds over ten feet not self-supported from ground up; skip man on concrete paving; wire mesh setters on concrete paving; all work in connection with sewer, water, gas, gasoling, oil, drainage pipe, conduit pipe, tile and duct lines and all other pipe lines; power tool operator; all work in connection with hydraulic or general dredging operations; form setters, puddlers (paving only); straw blower nozzle man; asphalt plant platform man; chuck tender; crusher feeder; men handling creosote ties or creosote materials; men working with and handling epoxy material; topser of standing trees; feeder man on wood pulverizers, board and willow mat weavers and cable tiers on river work; deck hands; pile dike and revetment work; all laborers working on underground tunnels less than 25 ft. where compressed air is not used; abutment and pier hole men working six (6) ft. or more below ground; men working in coffer dams for bridge piers and footing in the river; barco tamper; jackson or any other similar tamp; cutting torch man; liners, curb, gutters, ditch lines; hot mastic kettlemen; hot tar applicator; hand blade operator; mortar men or brick or block manholes; rubbing concrete, air tool operator under 65 lbs.; caulker and lead man; chain or concrete saw under 15 h.p.; signal Gan; Guard rail and sign erectors.

GROUP 2 - Skilled laborers - Vibrator man; asphalt raker; head pipe layer on sewer work; batterboard man on pipe and ditch work; cliff scalers working from bosun's chairs; scaffolds or platforms on dams or power plants over 10 ft. high; air tool operator over 65 lbs.; stringline man on concrete paving; sandblast man; laser beam man; wagon drill; churn drill; air track drill and all other similar type drills, gunite nozzle man; pressure grout man; screed man on asphalt; concrete saw 15 h.p. and over; grade checker; strigline man on electronic grade control; manhole builder; dynamite man; powder man; welder; tunnel man; waterblaster - 1000 psi or over; asbestos and/or hazardous waste removal and/or disposal

	Rates	Fringes
BUCHANAN, CASS AND LAFAYETTE COUNTIES		
LABORERS		
GROUP 1	17.54	5.94
GROUP 2	17.89	5.94

ANDREW, ATCHISON, BARRY, BARTON, BATES, BENTON, CALDWELL, CAMDEN, CARROLL, CEDAR, CHRISTIAN, CLINTON, DADE, DALLAS, DAVIESS, DEKALB, DOUGLAS, GREENE, GENTRY, GRUNDY, HARRISON, HENRY, HICKORY, HOLT, JASPER, JOHNSON, LACLEDE, LAWRENCE, LIVINGSTON, MCDONALD, MERCER, MORGAN, NEWTON, NODAWAY, OZARK, PETTIS, POLK, ST. CLAIR, SALINE, STONE, TANEY, VERNON, WEBSTER, WORTH AND WRIGHT COUNTIES.

LABORERS		
GROUP 1	16.24	5.69
GROUP 2	16.79	5.69

#### LABORERS CLASSIFICATIONS

GROUP 1: General Laborers - Carpenter tenders; salamander tenders; loading trucks under bins; hoppers & conveyors; track men & all other general laborers; air tool operator; cement handler-bulk or sack; dump man on earth fill; georgie buggy man; material batch hopper man; material mixer man (except on manholes); coffer dams; riprap pavers - rock, block or brick; signal man; scaffolds over ten feet not self-supported from ground up; skipman on concrete paving; wire mesh setters on concrete paving; all work in connection with sewer, water, gas, gasoline, oil drainage pipe, conduit pipe, tile and duct lines and all other pipe lines; power tool operator, all work in connection with hydraulic or general dredging operations; puddlers (paving only); straw blower nozzle man; asphalt plant platform man; chuck tender; crusher feeder; men handling creosote ties or creosote materials; men working with and handling epoxy material or materials (where special protection is required); rubbing concrete; topper of standing trees; batter board man on pipe and ditch work; feeder man on wood pulverizers; board and willow mat weavers and cable tiers on river work; deck hands; pile dike and revetment work; all laborers working on underground tunnels less than 25 feet where compressed air is not used; abutment and pier hole men working six (6) feet or more below ground; men working in coffer dams for bridge piers and footings in the river; ditchliners; pressure groutmen; caulker; chain or concrete saw; cliffscalers working from scaffolds, bosuns' chairs or platforms on dams or power plants over (10) feet above ground; mortarmen on brick or block manholes; toxic and hazardous waste work.

GROUP 2: Skilled Laborers - Head pipe layer on sewer work; laser beam man; Jackson or any other similar tamp; cutting torch man; form setters; liners and stringline men on concrete paving, curb, gutters; hot mastic kettelman; hot tar applicator; sandblasting

and gunite nozzlemen; air tool operator in tunnels; screed man on asphalt machine; asphalt raker; barco tamper; churn drills; air track drills and all similar drills; vibrator man; stringline man for electronic grade control; manhole builders-brick or block; dynamite and powder men; grade checker.

LABO0660H 03/07/2001

	Rates	Fringes
ST. CHARLES COUNTY		
LABORERS:		
GROUP 1	21.77	6.17
GROUP 2	21.77	6.17

#### LABORERS CLASSIFICATIONS

GROUP 1: General laborer; carpenter tender; salamander tender; dump man; ticket takers; flagman; loading trucks under bins, hoppers, and conveyors; track men; cement handler; dump man on earth fill; Georgie buggy man; material batch hopper man; spreader on asphalt machine; material mixer man (except on manholes); coffer dams; riprap paver - rock, block, or brick; signal man; scaffolds over 10 ft not self-supported from ground up; skipman on concrete paving; wire mech setters on concrete paving; all work in connection with sewer, water, gas, gasoline, oil, drainage pipe, conduit pipe, tile and duct lines and all other pipe lines; power tool operator; all work in connection with hydraulic or general dredging operations; form setters; puddlers (paving only); straw blower nozzle man; asphalt plant platform man; chuck tender; crusher feeder; men handling creosote ties or creosote materials; men working with and handling epoxy material; topper of standing trees; feeder man on wood pulverizer; board and w llow mat weavers and cable tiers on river work; deck hands; pile dike and revetment work; all laborers working on underground tunnels less than 25 ft where compressed air is not used; abutment and pier hole men working 6 ft or more below ground; men working in coffer dams for bridge piers and footings in the river; Barco tamper, Jackson or any other similar tamp; cutting torch man; liners, curb, gutters, ditchliners; hot mastic kettleman; hot tar applicator; hand blade operators; mortar men on brick or block manholes; rubbing concrete; air tool operator under 65 pounds; caulker and lead man; chain saw under 15 hp; guard rail and sign erectors

GROUP 2: Vibrator man; asphalt raker; hand pipe layer on sewer work; batterboard man on pipe and ditch work; cliff scalers working from Bosun's chairs, scaffolds or platforms on dams or power plants over 10 ft high; air tool operator over 65 pounds; stringline man on concrete paving etc.; sand blast man; laser beam man; wagon drill; churn drill; air track drill and all other similar type drills; gunnite nozzle man; pressure grout man; screed man on asphalt; concrete saw 15 hp and over; grade checker; stringline man on electronic grade control; manhole

builder; dynamite man; powder man; welder; tunnel man;

waterblaster - 1000 psi and over; asbestos and/or hazardous waste removal and or disposal;

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LABO0663D 04/01/2001

CASS (Richards-Gebaur Air Force Base ONLY) CLAY, JACKSON, PLATTE, AND RAY COUNTIES

LABORERS:

	Rates	Fringes
GROUP 1	20.59	6.74
GROUP 2	21.64	6.74

LABORERS CLASSIFICATIONS

GROUP 1: General laborers, Carpenter tenders, salamander tenders, loading trucks under bins, hoppers and conveyors, track men and all other general laborers, air tool operator, cement handler (bulk or sack), chain or concrete saw, deck hands, dump man on earth fill, Georgie Buggies man, material batch hopper man, scale man, material mixer man (except on manholes), coffer dams, abutments and pier hole men working below ground, riprap pavers rock, black or brick, signal man, scaffolds over ten feet not self-supported from ground up, skipman on concrete paving, wire mesh setters on concrete paving, all work in connection with sewer, water, gas, gasoling, oil, drainage pipe, conduit pipe, tile and duct lines and all other pipelines, power tool operator, all work in connection with hydraulic or general dredging operations, straw blower nozzleman, asphalt plant platform man, chuck tender, crusher feeder, men handling creosote ties on creosote materials, men working with and handling epoxy material or materials (where special protection is required), topper of standing trees, batter board man on pipe and ditch work, feeder man on wood pulverizers, board and willow mat weavers and cable tiers on river work, deck hands, pile dike and revetment work, all laborers working on underground tunnels less than 25 feet where compressed air is not used, abutment and pier hole men working six (6) feet or more below ground, men working in coffer dams for bridge piers and footings in the river, ditchliners, pressure groutmen, caulker and chain or concrete saw, cliffscalers working from scaffolds, bosuns' chairs or platforms on dams or power plants over (10) feet above ground, mortarmen on brick or block manholes, signal man.

GROUP 2: Skilled Laborer - spreader or screed man on asphalt machine, asphalt raker, grade checker, vibrator man, concrete saw over 5 hp., laser beam man, barco tamper, jackson or any other similar tamp, wagon driller, churn drills, air track drills and other similar drills, cutting torch man, form setters, liners and stringline men on concrete paving, curb, gutters and etc., hot mastic kettelman, hot tar applicator, hand blade operators, mortar men on brick or block manholes, sand blasting and gunnite nozzle men, rubbing concrete, air tool operator in tunnels, head pipe layer on sewer work, manhole builder (brick or block), dynamite and powder men.

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PAIN0002B 09/01/2000

Rates Fringes  
CLARK, FRANKLIN, JEFFERSON, LEWIS, LINCOLN, MARION, PIKE, RALLS,  
ST. CHARLES, ST. LOUIS (CITY & COUNTY), AND WARREN COUNTIES

PAINTERS:

Brush	22.93	7.20
Spray	24.93	7.20

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PAIN0003D 04/01/2000

Rates Fringes  
BATES, BENTON, CALDWELL, CARROLL, CASS, CLAY, CLINTON, COOPER,  
DAVISS, GRUNDY, HARRISON, HENRY, JACKSON, JOHNSON, LAFAYETTE,  
LIVINGSTON, MERCER, MONITEAU, MORGAN, PETTIS, PLATTE, RAY AND  
SALINE COUNTIES

PAINTERS:

Brush & Roller; Taper	22.10	6.01
Bazooka; Paperhanger	22.60	6.01
Storage Bin & Tanks (Roller or Brush); Elevated Tanks (Roller or Brush); Stageman; Beltman; Bridgeman; Steelman; Sand Blast (Base); Elevator Shaft	22.85	6.01
Lead Abatement; Sprayman	23.10	6.01
Sandblast (Bridge, Stage, Erected Steel and Storage Bin and Tanks)	23.60	6.01
Sprayman (Storage Bin & Tanks, Elevated Tanks); Stageman (Spray); Bridgeman (Spray); Steelman (Spray)	23.85	6.01
Steeplejack (other than Elevated Tanks)	26.79	6.01
Steeplejack -Spray or Sandblast (other than Elevated Tanks)	27.79	6.01

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PAIN0098B 05/01/2000

Rates Fringes  
ANDREW, ATCHISON, BUCHANAN, DE KALB, GENTRY, HOLT, NODAWAY &  
WORTH COUNTIES

PAINTERS:

Brush & Roller	20.50	4.40
Sandblasters	21.50	4.40
Steeple Jack	23.50	4.40

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PAIN0203B 04/01/1999

Rates Fringes  
BARRY, BARTON, CEDAR, CHRISTIAN, DADE, DALLAS, DOUGLAS, GREENE,  
  
HICKORY, HOWELL, JASPER, LAWRENCE, MCDONALD, NEWTON, OZARK, POLK,  
ST. CLAIR, STONE, TANEY, VERNON, WEBSTER and WRIGHT COUNTIES



PAINTERS:

Sandblasters & Highman (over 40')	17.68	3.23
Painters	17.38	3.23
Tapers	16.47	3.21

PAIN1185C 04/16/1999

	Rates	Fringes
ADAIR, AUDRAIN, BOONE, CALLAWAY, CHARITON, COLE, GASCONADE, HOWARD, KNOX, LINN, MACON, MONROE, MONTGOMERY, OSAGE, PUTNAM, RANDOLPH, SCHUYLER, SCOTLAND, SHELBY AND SULLIVAN COUNTIES and the City of Booneville.		

PAINTERS:

Brush, Roller, Paperhanger, Tapers	17.34	1.98
Tapers using Ames or comparable tools (bazooks, etc.)	17.59	1.98
Spray; Water Base Epoxy; Stage Under 50 ft.;		
Structural Steel (except for stairs and railings)	17.84	1.98
Sandblasting; Epoxy or Any Two Part Coating; Stage or Other Aerial Work Platforms Over 50 ft. high;		
Lead Abatement	18.34	1.98
Bridges, Dams, Locks or Powerhouses	19.34	1.98

PAIN1265C 07/01/2000

	Rates	Fringes
CAMDEN, CRAWFORD, DENT, LACLEDE, MARIES, MILLER, PHELPS, PULASKI AND TEXAS COUNTIES		

PAINTERS:

Brush and Roller	16.91	7.01
Spray, Structural Steel, Sandblasting and all Tank Work	18.16	7.01
Lead Abatement	19.16	7.01

PAIN1292B 07/01/2000

	Rates	Fringes
BOLLINGER, BUTLER, CAPE GIRARDEAU, CARTER, DUNKLIN, MISSISSIPPI, NEW MADRID, OREGON, PEMISCOT, PERRY, REYNOLDS, RIPLEY, SCOTT, SHANNON, STODDARD and WAYNE COUNTIES		

PAINTERS:

Commercial	15.20	5.51
Industrial	17.70	5.51
Bridges, Stacks & Tanks	22.65	5.51

Taper (Tools)	15.45	5.51
Spray & Abrasive Blasting	17.20	5.51
Waterblasting	17.20	5.51

Height Rates (All Areas): Over 60 ft. \$0.50 per hour.  
Under 60 ft. \$0.25 per hour.

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PAIN1292F 07/01/2000

	Rates	Fringes
IRON, MADISON, ST. FRANCOIS, STE. GENEVIEVE and WASHINGTON COUNTIES		

PAINTERS:

Commercial	17.30	5.51
Industrial	18.30	5.51
Tapers (Tools)	17.55	5.51
Bridges, Stacks & Tanks	22.65	5.51
Spray & Abrasive Blasting	19.30	5.51
Waterblasting	19.30	5.51
Lead Abatement	18.05	5.51

Height Rates (All Areas): Over 60 ft. \$0.50 per hour  
Under 60 ft. \$0.25 per hour.

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PLAS0518F 04/01/2001

	Rates	Fringes
BARRY, BARTON, CEDAR, CHRISTIAN, DADE, DALLAS, DOUGLAS, GREENE, HOWELL, JASPER, LACLEDE, LAWRENCE, MCDONALD, NEWTON, OZARK, POLK, STONE, TANEY, VERNON, WEBSTER, AND WRIGHT COUNTIES		

CEMENT MASONS	17.31	2.99
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PLAS0518G 04/01/2001

	Rates	Fringes
CASS (Richards-Gebaur AFB only), CLAY, JACKSON, PLATTE AND RAY COUNTIES		

CEMENT MASONS	21.25	8.15
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PLAS0518K 05/01/2001

	Rates	Fringes
ANDREW, ATCHISON, BUCHANAN, BATES, CALDWELL, CARROLL, CASS (Except Richards-Gebaur AFB) CLINTON, DAVIESS, DEKALB, GENTRY, GRUNDY, HARRISON, HOLT, JACKSON, LAFAYETTE, LIVINGSTON, MERCER, NODAWAY AND WORTH COUNTIES		

CEMENT MASONS	23.13	7.15
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PLAS0527A 05/01/2001

	Rates	Fringes
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JEFFERSON, ST. CHARLES COUNTIES  
AND ST. LOUIS (City and County)

CEMENT MASONS	24.48	8.85
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FRANKLIN, LINCOLN, AND WARREN COUNTIES

CEMENT MASONS	23.31	8.85
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PLAS0527D 06/01/2001

	Rates	Fringes
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CRAWFORD, DENT, IRON, MADISON, MARION, PHELPS, PIKE, PULASKI,  
RALLS, REYNOLDS, ST. FRANCOIS, STE. GENEVIEVE, SHANNON, TEXAS,  
WASHINGTON COUNTIES

CEMENT MASONS	22.00	8.76
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PLAS0908A 05/01/2000

	Rates	Fringes
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BOLLINGER, BUTLER, CAPE GIRARDEAU, CARTER, DUNKLIN, MISSISSIPPI,  
NEW MADRID, OREGON, PEMISCOT, PERRY, RIPLEY, SCOTT, STODDARD, AND  
WAYNE COUNTIES

CEMENT MASONS	17.40	6.20
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PLAS0908G 03/01/2001

	Rates	Fringes
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BENTON, CALLAWAY, CAMDEN, COLE, GASCONADE, HENRY, HICKORY,  
JOHNSON, MARIES, MILLER, MONTGOMERY, MORGAN, OSAGE, PETTIS,  
SALINE & ST. CLAIR COUNTIES

CEMENT MASONS	18.61	5.65
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PLUM0008C 06/01/2000

	Rates	Fringes
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CASS, CLAY, JACKSON, JOHNSON, PLATTE COUNTIES

PLUMBERS	26.44	9.87
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BATES, BENTON, CARROLL, HENRY, LAFAYETTE, MORGAN,  
PETTIS, RAY, ST. CLAIR, SALINE, AND VERNON COUNTIES

PLUMBERS	24.00	9.87
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PLUM0035C 01/01/2000

	Rates	Fringes
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CAMDEN, COLE, CRAWFORD, FRANKLIN, JEFFERSON, MARIES, MILLER,  
MONITEAU, OSAGE, PHELPS, PULASKI, ST. CHARLES, ST. LOUIS (City  
and County), WARREN and WASHINGTON COUNTIES

PLUMBERS	26.105	9.74
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PLUM0045D 12/15/2000

	Rates	Fringes
ANDREW, ATCHISON, BUCHANAN, CALDWELL, CLINTON, DAVIESS, DEKALB, GENTRY, HARRISON, HOLT, NODAWAY AND WORTH COUNTIES		

PLUMBERS & PIPEFITTERS	25.65	9.00
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PLUM0178D 11/01/2000

	Rates	Fringes
BARRY, CEDAR, CHRISTIAN, DADE, DALLAS, DOUGLAS, GREENE, HICKORY, LACLEDE, LAWRENCE, POLK, STONE, TANEY, WEBSTER, AND WRIGHT COUNTIES		

PLUMBERS & PIPEFITTERS	21.10	7.37
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PLUM0317B 07/01/1995

	Rates	Fringes
BOONE, CALLAWAY, COOPER, HOWARD, AND RANDOLPH COUNTY (Southern half)		

PLUMBERS & PIPEFITTERS	19.18	3.17
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PLUM0533E 06/01/2001

	Rates	Fringes
BATES, BENTON, CARROLL, CASS, CLAY, HENRY, HICKORY, JACKSON, JOHNSON, LAFAYETTE, MORGAN, PETTIS, PLATTE, RAY, SALINE, ST. CLAIR AND VERNON COUNTIES		

PIPEFITTERS	28.38	11.08
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\* PLUM0562D 07/01/2001

	Rates	Fringes
ADAIR, AUDRAIN, BOLLINGER, BUTLER, CAMDEN, CAPE GIRARDEAU, CARTER, CHARITON, CLARK, COLE, CRAWFORD, DENT, DUNKLIN, FRANKLIN, GASCONADE, GRUNDY, HOWELL, IRON, JEFFERSON, KNOX, LEWIS, LINCOLN, LINN, LIVINGSTON, MACON, MADISON, MARIES, MARION, MERCER, MILLER, MISSISSIPPI, MONITEAU, MONROE, MONTGOMERY, NEW MADRID, NORTHERN HALF OF RANDOLPH, OREGON, OSAGE, PEMISCOTT, PERRY, PHELPS, PIKE, PULASKI, PUTNAM, RALLS, REYNOLDS, RIPLEY, ST. CHARLES, ST. FRANCOIS, STE. GENEVIEVE, ST. LOUIS, SCHUYLER, SCOTLAND, SCOTT, SHANNON, SHELBY, STODDARD, SULLIVAN, TEXAS, WARREN, WASHINGTON, AND WAYNE COUNTIES.		

PIPEFITTERS	27.75	11.83
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PLUM0658B 07/01/1998

	Rates	Fringes
BARTON, JASPER, MCDONALD, AND NEWTON COUNTIES		

## PLUMBERS &amp; PIPEFITTERS

16.73

5.33

TEAM0013H 05/01/2001

	Rates	Fringes
AUDRAIN, BOLLINGER, BOONE, CALLAWAY, CAPE GIRARDEAU, CARTER, COLE, CRAWFORD, DENT, GASCONADE, IRON, MACON, MADISON, MARIES, MARION, MILLER, MISSISSIPPI, MONROE, MONTGOMERY, NEW MADRID, OSAGE, PEMISCOT, PERRY, PHELPS, PIKE, PULASKI, RALLS, REYNOLDS, ST. FRANCOIS, STE. GENEVIEVE, SCOTT, SHANNON, SHELBY, STODDARD, TEXAS, WASHINGTON, AND WAYNE COUNTIES		

## TRUCK DRIVERS:

GROUP 1	21.72	5.25
GROUP 2	21.87	5.25
GROUP 3	21.88	5.25
GROUP 4	21.99	5.25

ADAIR, BUTLER, CLARK, DUNKIN, HOWELL, KNOX, LEWIS, OREGON, PUTNAM, RIPLEY, SCHUYLER, AND SCOTLAND COUNTIES

## TRUCK DRIVERS:

GROUP 1	20.99	5.25
GROUP 2	21.14	5.25
GROUP 3	21.15	5.25
GROUP 4	21.26	5.25

## TRUCK DRIVERS CLASSIFICATIONS:

GROUP 1: Flat Bed Trucks, Single Axle; Station Wagons; Pickup Trucks; Material Trucks, Single Axle; Tank Wagon, Single Axle

GROUP 2: Agitator and Transit Mix Trucks

GROUP 3: Flat Bed Trucks, Tandem Axle; Articulated Dump Trucks; Material Trucks, Tandem Axle; Tank Wagon, Tandem Axle

GROUP 4: Semi and/or Pole Trailers; Winch, Fork & Steel Trucks; Distributor Drivers and Operators; Tank Wagon, Semi-Trailer; Insley Wagons, Dumpsters, Half-Tracks, Speedace, Euclids and other similar equipment; A-Frame and Derrick Trucks; Float or Low Boy

TEAM0056A 05/01/1998

	Rates	Fringes
BUCHANAN, CASS (Except Richards-Gebaur AFB), JOHNSON, AND LAFAYETTE COUNTIES		

## TRUCK DRIVERS:

GROUP 1	20.13	4.75
GROUP 2	20.24	4.75
GROUP 3	20.28	4.75
GROUP 4	20.35	4.75

ANDREW, BARTON, BATES, BENTON, CALDWELL, CAMDEN, CARROLL, CEDAR, CHARITON, CHRISTIAN, CLINTON, COOPER, DADE, DALLAS, DAVIESS, DEKALB, DOUGLAS, GREENE, HENRY, HICKORY, HOWARD, JASPER, LACLEDE,

LAWRENCE, LINN, LIVINGSTON, MONITEAU, MORGAN, NEWTON, PETTIS,  
POLK, RANDOLPH, ST CLAIR, SALINE, VERNON, WEBSTER, AND WRIGHT  
COUNTIES

TRUCK DRIVERS:

GROUP 1	18.92	4.75
GROUP 2	19.07	4.75
GROUP 3	19.08	4.75
GROUP 4	19.19	4.75

ATCHISON, BARRY, GENTRY, GRUNDY, HARRISON, HOLT, MCDONALD,  
MERCER, NODADWAY, OZARK, STONE, SULLIVAN, TANEY AND WORTH  
COUNTIES

TRUCK DRIVERS:

GROUP 1	18.19	4.75
GROUP 2	18.34	4.75
GROUP 3	18.35	4.75
GROUP 4	18.46	4.75

TRUCK DRIVER CLASSIFICATIONS

GROUP 1: Flat bed trucks single axle; station wagons; pickup  
trucks; material trucks single axle; tank wagons  
single axle.

GROUP 2: Agitator and transit mix-trucks.

GROUP 3: Flat bed trucks tandem axle; articulated dump trucks;  
material trucks tandem axle; tank wagons tandem  
axle.

GROUP 4: Semi and/or pole trailers; winch, fork & steel trucks;  
distributor drivers & operators; tank wagons semi-  
trailer; insley wagons, dumpsters, half-tracks,  
speedace, euclids & other similar equipment;  
A-frames and derrick trucks; float or low boy.

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TEAM0245C 03/25/1998

	Rates	Fringes
BARRY, BARTON, CAMDEN, CEDAR, CHRISTIAN, DALLAS, DENT, DOUGLAS, GREENE, HICKORY, HOWELL, JASPER, LACLEDE, LAWRENCE, MCDONALD,		

MILLER, NEWTON, OZARK, PHELPS, POLK, PULASKI, SHANNON, STONE,  
TANEY, TEXAS, VERNON, WEBSTER AND WRIGHT COUNTIES

TRUCK DRIVERS:

Traffic Control Service Driver	12.90	3.56+a
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PAID HOLIDAYS: New Year's Day, Decoration Day, July 4th,  
Labor Day, Thanksgiving Day, Christmas Day,  
Employee's birthday and 2 personal days.

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TEAM0541A 04/01/2001

	Rates	Fringes
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CASS (Richards-Gebaur AFB), CLAY, JACKSON, PLATTE, AND RAY  
COUNTIES

TRUCK DRIVERS:

GROUP 1	22.81	6.50
GROUP 2	22.32	6.50
GROUP 3	21.84	6.50

TRUCK DRIVERS CLASSIFICATIONS

GROUP 1: Mechanics and Welders, Field; A-Frame Low Boy-Boom  
Truck Driver.

GROUP 2: Articulated Dump Truck; Insley Wagons: Dump Trucks,  
Excavating, 5 cu yds and over; Dumpsters; Half-Tracks:  
Speedace: Euclids & similar excavating equipment.

Material trucks, Tandem Two teams; Semi-Trailers;  
Winch trucks-Fork trucks; Distributor Drivers  
and Operators; Agitator and Transit Mix; Tank Wagon  
Drivers, Tandem or Semi; One Team; Station Wagons;  
Pickup Trucks; Material Trucks, Single Axle; Tank  
Wagon Drivers, Single Axle

GROUP 3: Oilers and Greasers - Field

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TEAM0541C 03/25/2000

	Rates	Fringes
BATES, CASS, CLAY, HENRY, JACKSON, JOHNSON, LAFAYETTE, PLATTE, AND RAY COUNTIES		

TRUCK DRIVERS:

Traffic Control Service Driver	14.15	2.44+a
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a. PAID HOLIDAYS: New Year's Day, Decoration Day, July 4th,  
Labor Day, Thanksgiving Day, Christmas Day,  
Employee's birthday and 2 personal days.

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TEAM0682D 05/01/2000

	Rates	Fringes
ST LOUIS CITY AND COUNTY		

TRUCK DRIVERS:

GROUP 1	21.105	4.76+a+b
GROUP 2	21.305	4.78+a+b
GROUP 3	21.405	4.79+a+b

a. PENSION: \$18.80 per day, \$94.00 maximum per week.

b. HAZMAT PREMIUM: If Hazmat certification on a job site is  
required by a state or federal agency or requested by project  
owner or by the employer, employees on that job site shall  
receive \$1.50 premium pay.

TRUCK DRIVERS CLASSIFICATIONS

GROUP 1 - Pick-up trucks; forklift, single axle; flatbed trucks;

job site ambulance, and trucks or trailers of a water level capacity of 11.99 cu. yds. or less

GROUP 2 - Trucks or trailers of a water level capacity of 12.0 cu yds. up to 22.0 cu yds. including euclids, speedace and similar equipment of same capacity and compressors

GROUP 3 - Trucks or trailers of a water level capacity of 22.0 cu. yds & over including euclids, speedace & all floats, flatbed trailers, boom trucks, winch trucks, including small trailers, farm wagons tilt-top trailers, field offices, tool trailers, concrete pumps, concrete conveyors & gasoline tank trailers and truck mounted mobile concrete mixers

FOOTNOTE FOR TRUCK DRIVERS:

a. PAID HOLIDAYS: Christmas Day, Independence Day, Labor Day, Memorial Day, Veterans Day, New Years Day, Thanksgiving Day

PAID VACATION: 3 days paid vacation for 600 hours of service in any one contract year; 4 days paid vacation for 800 hours of service in any one contract year; 5 days paid vacation for 1,000 hours of services in any one contract years.

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TEAM0682E 05/01/2000

Rates Fringes  
ST.CHARLES, FRANKLIN, JEFFERSON, LINCOLN AND WARREN COUNTIES:

TRUCK DRIVERS:

GROUP 1	21.105	3.29+a+b+c
GROUP 2	21.305	3.29+a+b+c
GROUP 3	21.405	3.29+a+b+c

a.PAID HOLIDAYS: Christmas, Fourth of July, Labor Day, Memorial Day, Veterans Day, to be celebrated on either

its National Holiday or on the day after Thanksgiving, whichever is agreed upon by the Association and the Union, New Year's Day and Thanksgiving Day.

b.Pension: \$18.80 per day either worked or compensated to a maximum of \$94.00 per week.

c.Hazmat Pay: If Hazmat Certification on a job site is required by a state or federal agency or requested by project owner or by the employer, employees on that job site shall receive \$1.50 per hour premium pay.

TRUCK DRIVER CLASSIFICATIONS:

GROUP 1: Trucks or Trailers of a Water Level Capacity of 11.99 cu. yds. or less, Forklift Trucks, Job Site Ambulances, Pickup Trucks, Flatbed Trucks.

GROUP 2: Trucks or Trailers of a Water Level Capacity of 12.0 cu. yds. up to 22 cu. yds., Euclids, Speedace and Similar Equipment of Same Capacity and Compressors.

GROUP 3: Trucks or Trailers of a Water Level Capacity of 22.0



cu. yds. and over, Euclids and all Floats, Flatbed Trailers, Boom Trucks, Winch Trucks, Including Small Trailers, Farm Wagons, Tilt Top Trailers, Tool Trailers, Concrete Pumps, Concrete Conveyors, Gasoline Tank Trailers, Truck Mounted Mobile Concrete Mixers, End Dump, Side Dump and Articulated Dump Trucks.

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5(a)(1)(v)).

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In the listing above, the "SU" designation means that rates listed under that identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

#### WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- \* an existing published wage determination
- \* a survey underlying a wage determination
- \* a Wage and Hour Division letter setting forth a

position on a wage determination matter

- \* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations  
Wage and Hour Division  
U. S. Department of Labor  
200 Constitution Avenue, N. W.  
Washington, D. C. 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator

(See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator  
U.S. Department of Labor  
200 Constitution Avenue, N. W.  
Washington, D. C. 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board  
U. S. Department of Labor  
200 Constitution Avenue, N. W.  
Washington, D. C. 20210

4.) All decisions by the Administrative Review Board are final.  
END OF GENERAL DECISION

GENERAL DECISION MO010002 07/06/01 MO2  
General Decision Number MO010002

Superseded General Decision No. MO000002

State: Missouri

Construction Type:  
BUILDING

County(ies):

CASS	JOHNSON	RAY
CLAY	LAFAYETTE	
JACKSON	PLATTE	

BUILDING CONSTRUCTION PROJECTS (Does not include single family homes and apartments up to and including 4 stories)

Modification Number	Publication Date
0	03/02/2001
1	04/13/2001
2	05/04/2001
3	05/11/2001
4	06/01/2001
5	07/06/2001

COUNTY(ies):

CASS	JOHNSON	RAY
CLAY	LAFAYETTE	
JACKSON	PLATTE	

ASBE0027B 10/01/2000

	Rates	Fringes
ASBESTOS WORKERS/INSULATORS Includes the application of all insulating materials, protective coverings, coatings and finishes to all types of mechanical systems. Also the application of firestopping material for wall openings and penetrations in walls, floors, ceilings and curtain walls.	25.04	11.18

BOIL0083F 09/01/1999

	Rates	Fringes
BOILERMAKERS	22.58	10.11

BRMO0003A 12/01/1998

	Rates	Fringes
MARBLE MASONS, TERRAZZO WORKERS AND TILE LAYERS	22.85	3.95

BRMO0003B 06/01/2000

TILE FINISHERS	Rates 18.10	Fringes 2.20
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BRMO0015B 04/01/2001		
BRICKLAYERS	Rates 22.95	Fringes 9.35
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CARP0007D 04/01/1999		
CASS, CLAY, JACKSON, PLATTE AND RAY COUNTIES	Rates	Fringes
CARPENTERS, LATHERS, MILLWRIGHTS and PILEDRIVERS	22.95	5.95
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CARP0007H 04/01/1999		
JOHNSON AND LAFAYETTE COUNTIES:	Rates	Fringes
CARPENTERS & LATHERS	20.78	5.95
MILLWRIGHTS & PILEDRIVERS	22.95	5.95
-----		
ELEC0124B 09/04/2000		
ELECTRICIANS (Including Low Voltage Installation Work)	Rates 27.01	Fringes 11.30
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ELEV0012A 07/03/2000		
ELEVATOR MECHANICS	Rates 26.505	Fringes 6.935+a
<p>a. VACATION: Employer contributes 8% of basic hourly rate to vacation pay credit for employee who has worked in business more than 5 years and 6% for 6 months to 5 years as Vacation Pay Credit.</p> <p>PAID HOLIDAYS: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Friday after Thanksgiving Day and Christmas Day.</p>		
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ENGI0101R 04/01/1999		
POWER EQUIPMENT OPERATORS:	Rates	Fringes
GROUP 1	21.81	7.15
GROUP 2	21.00	7.15
GROUP 3:		
(a)	16.25	7.15
(b)	17.05	7.15
(c)	19.41	7.15
(d)	19.66	7.15
GROUP 4	23.66	7.15
GROUP 5	23.16	7.15

# POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Cranes 150 ft. or less of Boom; Overhead Cranes; Hydraulic Cranes; Cherry Picker; Pile Drivers; Derrick and Derrick Cars (Power Operated); Clamshells; Concrete Mixer Paver; Grade-all-similar type; Hoist Operator; (Drum and Cable type)

GROUP 2: Asphalt Paver and Spreader; Asphalt Plant Mixer Operators; Asphalt Plant Operator; Back Hoe (all types); Barber-Green loader (similar type); Blade-power (all types); Boats-Power; Bobcat or Skid-Loader; Boring Machine; Brooms-Power operated (all types); Chip Spreader (Front man); Concrete Pump (with tower, \$0.50 per hour additional); Concrete Saws, Self-Propelled; Curb Finishing Machine, Ditching Machine; Dozers; Finishing Machine; Greaser; Hoist Operator (Personnel or Material Hoist); Hydra Hammer (all types); Loaders (all types); Locomotives (all types); Mechanic and Welder; Mucking Machine; Pumps-Material

(all types); Rollers (all types); Self-propelled Rotary Drill; Shovel, Power; Side Boom; Testhole Machine;

## GROUP 3:

- (a) Oilers
- (b) Oiler driver; Elevator Operator (Automatic or Push Button)
- (c) Fork lift-masonry
- (d) A-frame trucks; fork lifts-all types (except masonry); mixers (with side loaders); pumps (with well points), dewatering systems, test or pressure pumps; tractors (except when hauling material) less than 50 h.p.

## GROUP 4: Master Mechanic

GROUP 5: Crane (Tower or Climbing); Other cranes with over 150 ft. of boom.

## HOURLY PREMIUMS:

Clamshells, 100 ft. of boom or over (excluding jib) (\$0.25)  
 Draglines, 100 ft. of boom or over (\$0.25)  
 Hoists, each additional drum over 1 drum (\$0.25)  
 Pile Drivers, 100 ft. of boom or over (excluding jib)(\$0.25)

IRON0010R	04/01/2001		
		Rates	Fringes
IRONWORKERS		22.70	11.63

LABO0264A	04/01/2001		
		Rates	Fringes
CASS, CLAY, JACKSON, and PLATTE COUNTIES			
LABORERS:			
GROUP 1		20.70	5.30
GROUP 2		21.10	5.30
GROUP 3		21.50	5.30

LAFAYETTE and RAY COUNTIES

LABORERS:

GROUP 1	19.70	5.30
GROUP 2	20.10	5.30
GROUP 3	20.50	5.30

LABORERS CLASSIFICATIONS

GROUP 1 : General Laborer; Wire Mesh Handlers or Setters; Carpenter Tender; Track Persons; Signal Person; Salamander Tenders; Landscape Persons; Sod Layers; Wreckers (For Alterations or Entire Projects); Plumber Laborers (Conduit Pipe, Sewer Work, Drain Tile and Duct Lines, Digging and Back Filling); Power Tool Operators; Pier Hole Diggers (Over 10 feet); Jackhammer and Chipping Hammer Operators; Chain Saw Operators; Concrete Saw Operators; Brsh Feeders or Pulverizers; Reinforcing Steel Handlers; Air Tamp Operators; Ditch Witch Operators; Swinging

Scaffolds; Georgia Buggies Self Propelled; Fork Lift; Hose Person; Insulation Person.

GROUP 2: Vibrator Operator; Fork Lift (Masonry); Brick Tender; Plasterer Tender; Stone Mason Tender (includes all Hod Carrier classification previously shown as Mortar person and Scaffolding)

GROUP 3: Cutting Torch or Burner Person Barco; Jackson or Similar Tamp Operators; Asphalt Rakers; Power Person; Mastic Hot Kettle Person; Sandblasting and Guniting Nozzle Person; Wagon and Churn Drill Operators; Removal of Hazardous Waste and/or Asbestos (Except from Mechanical Systems that are not going to be scrapped)

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LABO0663A 04/01/1999

	Rates	Fringes
JOHNSON COUNTY		
LABORERS		
GROUP 1	14.23	5.05
GROUP 2	14.73	5.05
GROUP 3	15.23	5.05

LABORERS CLASSIFICATIONS

GROUP 1: General laborers; carpenter tenders; track men; wreckers; reinforcing rod carriers; signal men and all other general laborers; plumber laborers, sewer work, water lines, conduit pipe, drain tile and duct lines; batter board man on pipe and ditch work and vibrator man.

GROUP 2: Air tool operators, pier hole men working below ground; jack hammer; chipping hammer operators; material batch hopper man; scale man; spreader or screed man on asphalt machine; chain or concrete saw; brush feeders on pulverizers; swinging scaffold; cement handlers (bulk or sack).

GROUP 3: Plaster tenders; hod carriers; brick tenders; stone mason tenders; cutting torch and burner men; asphalt rakers; Barco tamper; Jackson or any similar tamps; power buggy operator; powder man; mastic kettelman; sandblasting and gunnite nozzlemen; head pipe layer on sewer work; men working in tunnels; head form setters and string line men; hot tar applicator; asbestos abatement worker.

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PAIN0003A 04/01/2000

	Rates	Fringes
PAINTERS:		
Brush and Roller, Taper	22.10	6.01
Bazooka, Paperhangers	22.60	6.01
Storage Bin & Tanks (roller or brush); elevated tanks (roller or brush); stageman; beltman;		
bridgeman; steelman; sand blast (base); elevator shaft	22.85	6.01
Lead Abatement, Sprayman	23.10	6.01
Sandblast (bridge, stage, erected steel, storage bin & tank)	23.60	6.01
Sprayman (storage bin & tank, elevated tanks); Stageman (spray); Bridgeman (spray); Steelman (spray)	23.85	6.01
Steeplejack (other than elevated tanks)	26.79	6.01
Steeplejack - spray or sandblast (other than elevated tanks)	27.79	6.01

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PAIN0558B 10/01/2000

	Rates	Fringes
GLAZIERS (All of Cass, Clay, Jackson and Platte Counties and ONLY East of Highway 13 in Johnson, Lafayette and Ray Counties)	21.18	11.27

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PAIN0558I 10/01/2000

	Rates	Fringes
GLAZIERS (West of Highway 13 in Johnson, Lafayette and Ray Counties)	21.68	6.69

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PAIN1179C 10/01/2000

	Rates	Fringes
SOFT FLOOR LAYERS	23.00	5.40

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PLAS0518B 04/01/2001

	Rates	Fringes
CASS, CLAY, JACKSON, LAFAYETTE, PLATTE AND RAY COUNTIES		

CEMENT MASONS	23.13	7.15
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PLAS0518H 04/01/2001		
	Rates	Fringes
CASS, CLAY, JACKSON, LAFAYETTE, PLATTE & RAY COUNTIES		
PLASTERERS	24.15	5.15
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PLAS0908J 03/01/2001		
	Rates	Fringes
JOHNSON COUNTY:		
CEMENT MASONS	18.61	5.65
PLASTERERS	17.68	5.65
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PLUM0008A 06/01/2001		
	Rates	Fringes
PLUMBERS:		
CASS, CLAY, JACKSON, JOHNSON and PLATTE COUNTIES	27.19	10.86
LAFAYETTE and RAY COUNTIES	24.75	10.86
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PLUM0533A 06/01/2001		
	Rates	Fringes
PIPEFITTERS	28.38	11.08
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ROOF0020E 06/01/2001		
	Rates	Fringes
ROOFERS	24.45	6.89
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* SFMO0314B 07/01/2001		
	Rates	Fringes
SPRINKLER FITTERS	30.00	7.05
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* SHEE0002G 07/01/2001		
	Rates	Fringes
SHEET METAL WORKERS	30.54	8.68
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SUMO1028A 04/14/1999		
	Rates	Fringes
SPRINKLER FITTERS:		
Cass, Lafayette and Ray Counties	16.31	1.78
Clay County	17.45	3.12
Jackson County	17.34	3.33
Platte County	15.70	2.20
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TEAM0541H 04/01/1997

	Rates	Fringes
TRUCK DRIVERS:		
GROUP 1	18.19	4.75+a
GROUP 2	18.26	4.75+a
GROUP 3	18.39	4.75+a
GROUP 4	18.59	4.75+a

#### TRUCK DRIVER CLASSIFICATIONS

GROUP 1: Dump Truck Drivers; Flat Bed trucks; Pickup Trucks;  
GROUP 2: Semi-Truck; Steel Truck; Distributor Truck; Oiler and Greaser.

GROUP 3: Double Bottom Units (20 ton capacity and over); Fork Trucks; Heavy Excavating (Dumpsters, Euclids, etc.); Heavy Hauling, A-Frame and Winch Trucks; Hydraulically Operated Aerial Lift; Hydro Lift Trucks; Straddle Trucks; Wheel Tractors (when used for towing); Articulated Dump Truck.

GROUP 4: Mechanics.

a. VACATION: An employee who has worked 1300 hours or more for an employer during the last full year shall receive one week vacation with pay for that year.

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TEAM0541T 03/25/2000

	Rates	Fringes
TRUCK DRIVERS:		
Traffic Control Service Driver	14.15	2.44+a

a. PAID HOLIDAYS: New Year's Day, Decoration Day, July 4th, Labor Day, Thanksgiving Day, Christmas Day, Employee's birthday and 2 personal days.

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29 CFR 5.5(a)(1)(v)).

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In the listing above, the "SU" designation means that rates listed under that identifier do not reflect collectively bargained wage and fringe benefit rates. Other designations indicate unions whose rates have been determined to be prevailing.

#### WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can

be:

- \* an existing published wage determination
- \* a survey underlying a wage determination
- \* a Wage and Hour Division letter setting forth a position on a wage determination matter
- \* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour Regional Office for the area in which the survey was conducted because those Regional Offices have responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations  
Wage and Hour Division  
U. S. Department of Labor  
200 Constitution Avenue, N. W.  
Washington, D. C. 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator  
U.S. Department of Labor  
200 Constitution Avenue, N. W.  
Washington, D. C. 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board  
U. S. Department of Labor  
200 Constitution Avenue, N. W.  
Washington, D. C. 20210

4.) All decisions by the Administrative Review Board are final.  
END OF GENERAL DECISION

DIVISION 1 – GENERAL

01000	General Scope of Work and Project Management Plan
01100	General
01310	Project Schedule, Network Analysis System (NAS)
01330	Submittal Procedures
01410	Environment Protection
01451	Contractor Quality Control
01500	Temporary Construction Facilities
01780	Closeout Submittals

## SECTION 01000

GENERAL SCOPE OF WORK AND PROJECT MANAGEMENT PLAN  
07/01

## PART 1 GENERAL

## 1.1 HISTORY

The project was originally authorized as FY01 MCA (Military Construction Army) PN 47051, comprising one complete battalion training complex of 5 barracks buildings (company operations buildings), a battalion headquarters building, dining facility and chiller plant, plus associated site work. The project design was initiated in October of 1999 utilizing a nearly complete standard definitive trainee barracks design as developed by the Tulsa District, U.S. Army Corps of Engineers, and the U.S. Army Training and Doctrine Command. This is the first application of this standard design. The standard design will be used at various Army training installations across the United States. Fort Leonard Wood may construct up to 9 more similar complexes in the next 10 years. (Note a future twin complex adjacent to the project site.) In February 2000, the project was split between FY01 MCA PN 4705 comprising 2 barracks buildings, a battalion headquarters building, dining facility and chiller plant, plus associated site work and FY02 MCA PN 53439 comprising 3 barracks buildings and the booster pump station plus associated site work. Together both projects will construct a complete battalion-sized basic combat training complex and each project authorization (DD Form 1391) references the other. It is the full intent of the Congress of the United States and the Army to construct the entire complex. The projects have been designed as one project as is logically required.

## 1.2 SOLICITATION CONTRACT FORM

FY01 MCA PN 47051 was authorized and appropriated by Congress. FY02 MCA PN 53439 is part of the proposed FY02 appropriation and authorization bills being considered by Congress. It is highly probable that this portion of the project will be approved; however, there is no guarantee. If passed, the action could come late this calendar year and funding may not be available for the FY02 portion until December 2001 or January 2002, or later. In Section 00010, the Solicitation Contract Form contains various line items. Line Item 0001 is the basic contract and comprises a majority of the FY01 portion of the project. Line Item 0002 is an option and comprises the majority of the FY02 portion. It is required that the Government account for the projects separately and that the scope of work for each is very much approximate to the DD Form 1391 description. However, it is also required to exercise some flexibility. For example, earth moving operations must be initiated and conducted over the entire site; thus, the areas adjacent to the three barracks buildings of the FY02 portion are included in the basic contract and the Contractor is not restricted in his

operations.

### 1.3 FORCE PROTECTION

The project is designed to meet the requirements of Antiterrorism and Force Protection (AT/FP). Note that an 80-foot stand-off zone is incorporated into the design. Landscaping (not in this contract) will establish a perimeter to define the protected zone and to be indicative of improper encroachment by unauthorized vehicles into the site. It is not meant to be a physical barrier. Laminated blazing and heavy duty frames on windows and doors are used. The buildings are oriented to minimize blast effects. Numerous other features are part of the design.

### 1.4 CONSTRUCTION QUICK START PROGRAM

It is the desire of the Government that work commence as soon as practicable on this contract. This will allow quicker completion and occupation of the complex and will reduce overall costs. Each offeror will submit certain non-evaluated information concerning the initial safety plan and other information. Upon contract award, the successful offerors' information will be expeditiously reviewed and, if sufficient, the Notice to Proceed (NTP) will be issued at the earliest possible date. Further, the Government will support early efficient construction activity through expedited shop drawing review as described elsewhere.

### 1.5 TURNKEY CONTRACT

It is the desire of the Government to place much of the total project construction and actions under the umbrella and responsibility of the general contractor. This will shorten the total time from groundbreaking to having a fully operational complex. For example, the furniture purchase, delivery and installation for the buildings will be under this contract as well as certain free-standing food service equipment that is normally purchased and installed by others. Some project actions are not part of this contract.

### 1.6 FURNITURE

Furniture for the buildings is described in the specifications, and plans depict installation locations. The furniture was selected using current GSA furnishings contracts. The contracts can be found at [www.GSA.Gov](http://www.GSA.Gov). This can be a useful source for further information and contracts.

### 1.7 OTHER CONTRACTS AND ACTIONS ASSOCIATED WITH THE PROJECT

Other actions and contracts associated with the project are described below.

As indicated elsewhere, the Contractor will coordinate his activities with the Administrative Contracting Officer (ACO) and will cooperate with associated contractors to the best of his ability to facilitate a complete and usable total complex. With coordination and agreement of the ACO, Contractor and connecting utility and associated contractors, access to the facilities and site will be granted prior to beneficial occupancy.

- a. The Contractor is not responsible for landscaping except as

specifically noted. The landscaping of the site (topsoil, plantings, and establishment of turf) will be performed by a contractor for the Directorate of Public Works (DPW), Fort Leonard Wood.

b. The Contractor will install conduit system, pull wires, backboards and other features to facilitate the installation of phone and computer systems (local area networks). Actual installations of telephone and computer systems wiring, devices and instruments will be performed by a contractor for the Directorate of Information Management, Fort Leonard Wood. Pay phones throughout the project will be installed by Sprint.

c. Omega Pipeline, owners and operators of the gas distribution system, will install the gas distribution system. Fort Leonard Wood DPW will modify their contract to modify the distribution system and provide meters where required. Actual connection to the system is the responsibility of the Contractor.

d. The water, sewer and electrical distribution systems are the property of the Government, and coordination will be made with the DPW.

e. Cable television will be installed under contract by others.

f. Joint Services Intrusion Detection Systems (JSIDS) will be installed by others.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

## SECTION 01100

## GENERAL

## PART 1 GENERAL

## 1.1 INQUIRIES

Pursuant to SECTION 00100 paragraph titled "Instructions to Offerors--Competitive Acquisition", any inquiries regarding this Invitation, before bids are opened, should be addressed to the District Engineer, Kansas City District, Corps of Engineers, 700 Federal Building, Kansas City, Missouri 64106, ATTN: Mr. Roger McCollum. Inquiries for which oral explanation or advice on the plans and specifications will suffice may be referred to Mr. McCollum by calling Area Code 816-983-3460. Telephone calls concerning the mailing of plans and specifications should be made to Contracting Division at Area Code 816-983-3975. Collect telephone calls will not be accepted. (KCDO APR 84)

## 1.2 INFORMATION REGARDING PROPOSAL MATERIAL

Proposals must be submitted upon Government standard bid form (STANDARD FORM 1442 (Rev. 4-85)). Wherever in the proposal the words "invitation" and "bid" occur, they shall be deemed to refer to "solicitation" and "offer," respectively.

## 1.3 TIME FOR ACCEPTANCE BY THE GOVERNMENT OF PROPOSALS

All offerors submitting proposals in response to this request agree that the Government shall have not less than the number of days listed as follows to accept any proposal.

Furniture: calendar days after the date for Receipt of Proposals.

Item X: calendar days after the date for Receipt of Proposals.

Item Y: calendar days after the date for Receipt of Proposals.

Item Z: calendar days after the date for Receipt of Proposals.

## 1.4 DISPOSAL OF PROPOSALS

After award of the construction contract, proposal sets may be destroyed or may be kept for record. Proposal sets that are kept for records will be for Government use. Disclosure of proposal material, in whole or in part, outside the Government will be restricted only if the provisions of paragraph "Restriction on Disclosure and Use of Data" are in effect.

## 1.5 SUPERINTENDENCE OF SUBCONTRACTORS

(a) The Contractor shall be required to furnish the following:

(1) If more than 50% and less than 70% of the value of the contract work is

subcontracted, one superintendent shall be provided at the site and on the Contractor's payroll to be responsible for coordinating, directing, inspecting and expediting the subcontract work. This superintendent is an additional person above that required under the FAR Contract Clause 52.236-6.

(2) If 70% or more of the value of the work is subcontracted, the Contractor shall be required to furnish two such superintendents to be responsible for coordinating, directing, inspecting and expediting the subcontract work. These superintendents are above that required by FAR Contract Clause 52.236-6.

(b) If the Contracting Officer, at any time after 50% of the subcontracted work has been completed, finds that satisfactory progress is being made, he may waive all or part of the above requirement for additional superintendence subject to the right of the Contracting Officer to reinstate such requirement if at any time during the progress of the remaining work he finds that satisfactory progress is not being made.

#### 1.6 IDENTIFICATION OF EMPLOYEES

a. The Contractor shall be responsible for furnishing to each employee and for requiring each employee engaged on the work to display identification as may be approved and directed by the Contracting Office. All prescribed identification shall immediately be delivered to the Contracting Officer, for cancellation upon the release of any employee. When required by the Contracting Officer the Contractor shall obtain and submit fingerprints of all persons employed or to be employed on the project.

b. The contractor will be required to obtain a vehicle registration pass for each vehicle brought onto the installation, and each vehicle brought onto the installation by the Contractor's employees must be registered. To register a vehicle, the operator will be required to provide proof of vehicle registration, certificate of inspection, drivers license and proof of insurance.

c. Registration of vehicles for contractor personnel will be limited to two vehicles per individual.

#### 1.7 APPLICATION OF WAGE RATES

The inclusion of the Davis-Bacon Act General Wage Decision or the Service Contract Act Wage Determination in the solicitation is a statutory requirement. It is not a representation by the U.S. Army Corps of Engineers that any specific work task can be performed by any specific trade. Which work tasks can be performed by what trades depends on and is determined by the prevailing area practice for the local area where the contract is being performed. It is the sole responsibility of the offeror to determine and comply with the prevailing area practice. Inquiries regarding a prevailing area practice should be directed to the Corps of Engineers, Contractor Industrial Relations Specialist (telephone number 816-983-3723) or to the Department of Labor Regional Wage and Hour Division.

Application of wage rates and fringe benefits: For the application of the wage rates and fringe benefits contained in the Decisions of the Secretary



of Labor, attached to and a part of this contract, all work required within 5 feet outside building lines shall be considered Building (or Residential) Construction.

Highway construction rates apply to the construction, alteration or repair of roads, streets, highways, runways, taxiways, alleys, trails, paths, parking areas, and other similar projects.

All other construction not defined herein as Building (or Residential) Construction or Highway Construction is considered Heavy Construction.

#### 1.8 PAYMENTS TO SUBCONTRACTORS

The Contractor's attention is directed to CONTRACT CLAUSE titled "Payment Under Fixed-Price Construction Contracts." In addition to the requirements set forth in the referenced paragraph, the Government will reimburse the Contractor, upon request, for amount of premiums paid by the subcontractors for performance and payment bonds (including coinsurance and reinsurance agreements, when applicable) after the Contractor furnishes evidence of full payment to the surety.

#### 1.9 PAYMENTS TO CONTRACTOR (KCD MAY 90 - FORMERLY FAR 52.2/9101(a))

The following is an example of a Contractor's release of claims clauses required to comply with the provisions of paragraph (h) of the CONTRACT CLAUSE titled "Payments Under Fixed-Price Construction Contracts":

##### RELEASE OF CLAIMS

The undersigned Contractor under contract dated \_\_\_\_\_, 2000, between the United States of America and said Contractor for the \_\_\_\_\_ located at \_\_\_\_\_, in accordance with paragraph (h) of the CONTRACT CLAUSE titled "Payments Under Fixed-Price Construction Contracts" of said contract, hereby releases the United States, its officers, agents, and employees from any and all claims arising under or by virtue of said contract or any modification or change thereof except with respect to those claims, if any, listed below:

(Here itemize claims and amounts due.)

#### 1.10 PARTNERING

The Government intends to encourage the foundation of a cohesive partnership with the Contractor and its subcontractor. This partnership will be structured to draw on the strengths of each organization to identify and achieve mutual goals with the intent to complete the Contract within budget, on schedule and in accordance with plans and specifications. This partnership will be bilateral in makeup, and participation will be totally voluntary. Any cost associated with implementing this partnership will be agreed to by the Contractor and the Government, and will be shared equally with no change in Contract price. To implement this partnership initiative, it is anticipated that thirty (30) days after Notice to Proceed, a team building workshop will be conducted. Follow-up workshops will be held periodically throughout the duration of the Contract as agreed to by the

Contractor and the Government.

#### 1.11 PROSPECTIVE CONTRACTOR RESPONSIBILITY

Each bidder shall furnish, within 3 calendar days after receipt of request therefor, data which will show the bidder's ability to perform the work or services required by this Invitation for Bids. Such data shall include as a minimum: Bank certification of financial capability, or a financial statement not over 60 days old, which will be treated as confidential (if over 60 days old, a certificate shall be attached thereto stating that the financial condition is substantially the same or, if not the same, the changes that have taken place); names of commercial and financial reporting agencies from whom credit reports may be obtained; trade creditors; name and address of bonding company; business and construction experience; past record of performance of Government contracts; and construction plant and equipment available for this job, with resume of work in progress or other data that will assure that the bidder is in a position to perform the work within the time specified.

In addition, if the bid exceeds \$1,000,000, the bidder shall furnish upon request, a certified statement listing:

(a) Each contract awarded to him within the preceding three-month period exceeding \$1,000,000 in value with brief description of the contract.

(b) Each contract awarded to him within the preceding three-year period not already physically completed and exceeding \$5,000,000 in value with brief description of the contract.

(c) If the prospective Contractor is a joint venture, each joint venture member will be required to submit the above defined certification. There shall also be furnished any other available information which will serve to substantiate the bidder's qualifications as a responsible prospective Contractor. (KCD APR 84)

#### 1.12 PERFORMANCE OF WORK BY CONTRACTOR

Bidder's attention is directed to SPECIAL CLAUSE titled "Performance of Work by Contractor." The successful bidder will be required to furnish the Contracting Officer, a description of the work which he will perform with his own organization (e.g., earthwork, paving, etc.), the percentage of the total work this represents, and the estimated cost thereof. Such description of work to be performed by the Contractor's own organization shall be furnished to the Contracting Officer within 10 days after award of the contract.

#### 1.13 LABORATORY AND TESTING FACILITIES

The Contractor shall provide and maintain all measuring and testing devices, laboratory equipment, instruments, transportation, and supplies necessary to accomplish the required testing. All measuring and testing devices shall be calibrated at established intervals against certified standards. The Contractor's measuring and testing equipment shall be made available for use by the Government for verification of their accuracy and condition as well

as for any inspection or test desired pursuant to the CONTRACT CLAUSE titled "Inspection of Construction." The location of the laboratory shall be convenient to the site such that test results are available prior to proceeding with the next sequential phase of the work. (KCD)

#### 1.14 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER

(a) This provision specifies the procedure for determination of time extensions for unusually severe weather in accordance with the CONTRACT CLAUSE titled "Default: (Fixed Price Construction)." In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

(1) The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

(2) The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

(b) The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The Contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

##### MONTHLY ANTICIPATED ADVERSE WEATHER DELAY

##### WORK DAYS BASED ON (5) DAY WORK WEEK

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(14)	(8)	(5)	(6)	(7)	(8)	(6)	(5)	(6)	(4)	(3)	(10)

(c) Upon acknowledgment of the Notice to Proceed (NTP) and continuing throughout the contract, the Contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the Contractor's scheduled work day. The number of actual adverse weather delay days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph b, above, the Contracting Officer will convert any qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the CONTRACT CLAUSE titled "Default (Fixed Price Construction)." (ER 415-1-15)

#### 1.15 COORDINATION BETWEEN CONTRACTORS

(See CONTRACT CLAUSE titled "Other Contracts".) Construction work on another contract is underway concurrently with this Contract. The

obligations of the Contractor under this Contract will include jointly planning and scheduling the work, on a cooperative basis, with the other contractor involved in order to minimize delays and interferences. Alterations to systems installed under the other contract, including connections to sewer, waterlines, and bituminous pavement shown as existing, may not be in place.

#### 1.16 REQUIRED INSURANCE SCHEDULE

In accordance with CONTRACT CLAUSE titled "Insurance - Work On A Government Installation," the Contractor shall procure and maintain during the entire period of his performance under this contract the following minimum insurance.

Type	Amount
Workmen's Compensation State Statute	coverage complying with applicable
Employers' Liability	minimum amount of \$100,000.00
General Liability on Comprehensive Form of Policy	minimum limits of \$500,000 per occurrence for bodily injury which includes, but is not limited to, insurance for all work required herein
Comprehensive Automobile Liability	minimum limits of \$200,000 per person and \$500,000 per occurrence for bodily injury, and \$20,000 per occurrence for property damage

(End of clause)

#### 1.17 INTERRUPTIONS TO UTILITY SERVICES

A schedule showing the approximate times of interruptions of utility services and roads shall be submitted approximately 30 days in advance of interrupting services to make connections. Where it is necessary to interrupt services to make connections, the period of outage shall not last more than 8 hours, shall be conducted on Saturday or Sunday, and must be coordinated with those people affected by the outage.

#### 1.18 COOPERATION BETWEEN THE CONTRACTOR AND UTILITY COMPANIES

Relocation of utilities by the utility companies listed below will be necessary concurrently with the work under this contract. All coordinating shall be through, or with the knowledge of, the Contracting Officer. (KCD)

(a) The Contractor shall coordinate work with Omega Corporation (gas service, gas meter connection requirements, and/or building connection requirements), United Telephone (pay telephones), and Fort Leonard Wood for water sewer, telephone/data, and cable television.

(b) The cost of utilities will be borne by the Contractor.

## 1.19 DATE OF SAFETY AND HEALTH REQUIREMENTS MANUAL (EM 385-1-1)

(a) The date of the U.S. Army Corps of Engineers Safety and Health Requirements Manual in effect on the date of this solicitation is 3 September 1996. See Section 00700, Contract Clause titled "Accident Prevention."

(b) Section 06.I of EM 385-1-1 is deleted. Job hazard analysis for confined space entry procedures is still required, as per 01.A.09 of EM 385-1-1. OSHA Standards 29 CFR 1910.146 or 29 CFR 1926 shall apply.

(c) Before initiation of work at the job site, an accident prevention plan, written by the prime contractor for the specific work and hazards of the contract and implementing in detail the pertinent requirements of EM 385-1-1, will be reviewed and found acceptable by designated Government personnel.

## 1.20 COMPLIANCE WITH OCCUPATIONAL SAFETY AND HEALTH ACT (OSHA)

The Contractor shall comply with OSHA standards as well as the most current edition of the Corps of Engineers General Safety Requirements Manual (EM 385-1-1). The OSHA standards are subject to change and such changes may affect the Contractor in his performance under the contract. It is the Contractor's responsibility to know such changes and effective dates of changes.

## 1.21 CONSTRUCTION EQUIPMENT OWNERSHIP AND OPERATING EXPENSE SCHEDULE

Whenever a modification or equitable adjustment of contract price is required, the Contractor's cost proposal for equipment ownership and operating expenses shall be as set forth in SPECIAL CLAUSE titled "Equipment Ownership and Operating Expense Schedule." A copy of EP 1110-1-8 "Construction Equipment Ownership and Operating Expense Schedule" dated August 1995 can be ordered from the Government Printing Office (GPO) by calling Telephone No. 202-512-1800.

## 1.22 SUBMITTALS

(a) Submittal Procedures. See Division One SECTION: SUBMITTAL PROCEDURES, and SECTION 01780: CLOSEOUT SUBMITTALS.

(b) Purchase Orders: Each purchase order issued by the Contractor or his subcontractors for materials and equipment to be incorporated into the project, shall be maintained on file at the Contractor's field office for inspection and review by Government representatives. Each purchase order shall (1) be clearly identified with applicable DA contract number, (2) carry an identifying number, (3) be in sufficient detail to identify the material being purchased, (4) indicate a definite delivery date, and (5) display the DMS priority rating. At the option of the Contractor, the copies of the purchase orders may or may not indicate the price of the articles purchased. (MRD Ltr 22 Oct 74)

(c) Color Boards:

1. The Contractor shall submit a minimum of three (3) complete sets of color boards within 120 calendar days of receipt of Notice to Proceed. Construction color boards shall be submitted in a 3-ring notebook binder with all materials securely mounted on rigid 8-1/2 by 11-inch presentation (mat) board, with a maximum spread of 25-1/2 by 33 inches for foldouts, clearly coded regarding location of materials in the facility.
2. An index shall be provided listing pertinent contract specifications and drawings for each sample and any proposed substitutions or variances shall be so designated. The Contractor shall also certify, in writing, that all submittal items technically comply with the project specifications.
3. Color boards shall reflect all actual finish textures, patterns, and colors required for this contract as specified on the Interior Room Finish Schedule, the Exterior Finish Schedule and Interior Finish Materials Legend located in the Contract Drawings, and the sample requirements of the submittal registers. All materials must be labeled with the manufacturer's name, pattern and color reference. Patterned material samples (i.e., carpet) must be of sufficient size to enable evaluation of the pattern. Samples shall be keyed or coded to match any key or code system in the Contract Drawings.
4. The Contractor shall express mail a minimum of three (3) copies of the color boards to the Contracting Officer. The Contracting Officer will forward one copy of the colorboards to CENWK-PE-D for review and concurrence. Concurrence or comments will be provided not later than 45 calendar days after receipt of the submittal. This paragraph does not cover the quality of finishing materials. The quality, physical requirements, and method of installation shall be submitted with the appropriate shop drawings. The Contractor shall not submit any of the above requirements with the color boards. Specific locations where the various materials are required are shown on the drawings.

#### 1.23 DIFFERENCES IN DRAWINGS

In addition to the provisions of CONTRACT CLAUSE paragraph "Specifications and Drawings for Construction," the structural drawings shall govern in cases where they differ from the architectural drawings.

#### 1.24 DAMAGE TO WORK (1966 MAR OCE)

The responsibility for damage to any part of the permanent work shall be as set forth in the CONTRACT CLAUSE titled "Permits and Responsibilities." However, if, in the judgment of the Contracting Officer, any part of the permanent work performed by the Contractor is damaged by flood or earthquake, which damage is not due to the failure of the Contractor to take reasonable precautions or to exercise sound engineering and construction practices in the conduct of the work, the Contractor will make the repairs as ordered by the Contracting Officer and full compensation for such repairs will be made at the applicable contract unit or lump sum prices as fixed and established in the contract. If, in the opinion of the Contracting Officer, there are no contract unit or lump sum prices applicable to any

part of such work an equitable adjustment pursuant to CONTRACT CLAUSE titled, "Changes," of the contract, will be made as full compensation for the repairs of that part of the permanent work for which there are no applicable contract unit or lump sum prices. Except as herein provided, damage to all work (including temporary construction), utilities, materials, equipment and plant shall be repaired to the satisfaction of the Contracting Officer at the Contractor's expense, regardless of the cause of such damage.

#### 1.25 WORK ADJACENT TO ROADS AND HIGHWAYS

Where the construction work is on or adjacent to, or involves hauling over public or private roads, streets, or highways, all herein referred to as "roads," the said roads shall, except as otherwise specified or directed, be kept open for traffic at all times during the construction period. Further, the Contractor shall, during said construction, provide, erect and maintain warning signs, lanterns or torches or other safety devices and, when necessary, provide flagmen for protection of traffic to the satisfaction of the Contracting Officer and local authorities. The Contractor shall keep the right-of-way of the roads free of debris that might be caused to accumulate thereon by his operations, and upon completion of the work, shall clean up the said roads and repair any damage to the roads occasioned by his operations under this contract to the satisfaction of the Contracting Officer and local authorities having jurisdiction. The drainage from the roads shall not be obstructed by the construction work. The Contractor shall be responsible for obtaining and paying for all permits required for operation on all roads.

#### 1.26 APPROVED EQUAL

The drawings and the TECHNICAL PROVISIONS of these specifications may, in some instances, refer to certain items of equipment, material, or article by trade name. Unless stated as specific requirements References of this type shall not be construed as limiting competition, but shall be regarded as establishing a standard of quality. In this respect, the Contractor's attention is directed to CONTRACT CLAUSE titled "Material and Workmanship."

#### 1.27 SCHEDULE OF WORK

The Contractor's attention is directed to CONTRACT CLAUSE titled "Schedule for Construction Contracts," wherein if, in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by the Contracting Officer.

#### 1.28 UPKEEP OF ROADWAY AREAS WITHIN A MILITARY INSTALLATION WHICH THE CONTRACTOR USES

In addition to the requirements in CONTRACT CLAUSE titled "Operations and Storage Areas," the Contractor shall comply with the following requirements:

Where the construction work is on or adjacent to, or involves hauling over public roads, streets, or highways located on a military installation, all herein referred to as "roads," the said roads shall except as otherwise specified or directed, be kept open for traffic at all times during the construction period. The Contractor shall keep the roads including adjacent

construction site free of debris including litter, waste construction material, mud etc., that might be caused to accumulate thereon by his operations, and upon completion of the work, shall clean up the said roads and construction site and repair any damage occasioned with his operations under this contract to the satisfaction of the Contracting Officer. The drainage from the roads shall not be obstructed by the construction work.

#### 1.29 PROTECTION OF UTILITY LINES

(a) It shall be the Contractor's responsibility to protect all existing utility lines from damage during excavation for utilities systems. Any damage resulting to existing utility systems shall be repaired by the Contractor, to the satisfaction of the contracting officer, at no additional cost to the Government.

(b) All requests for access and/or locations must be made through the Contracting Officer's Representative (COR) or Resident Engineer. The Director of Public Works will work directly with the Resident Engineer to provide timely information to the Contractor.

#### 1.30 MODIFICATIONS PRIOR TO DATE SET FOR OPENING BIDS

The right is reserved, as the interest of the Government may require, to revise or amend the specifications or drawings or both prior to the date set for opening bids. Such revisions and amendments, if any, will be announced by an amendment or amendments to this Invitation for Bids. If the revisions and amendments are of a nature which requires material changes in quantities or prices bid or both, the date set for opening bids may be postponed by such number of days as in the opinion of the issuing officer will enable bidders to revise their bids. In such cases, the amendment will include an announcement of the new date for opening bids. (KCD APR 84)

#### 1.31 EXPEDITING NOTICE TO PROCEED

Notwithstanding the requirements of Block 12 on page 00010-1 of SECTION 00010 and SECTION 00100 paragraph titled "Late Submissions, Modifications, and Withdrawals of Bids," in order to expedite award of contract and issuance of NOTICE TO PROCEED, it is requested that an officer of the company or corporation determined to be the successful bidder shall appear in the office of the Commander, Kansas City District, Corps of Engineers, 757 Federal Building, 601 East 12th Street, Kansas City, Missouri, for signing contract documents. Therefore, upon written acceptance of this bid, mailed or otherwise furnished within 60 calendar days after the date of opening of bids, it is requested that the successful bidder shall within 48 hours after receipt of notification appear in the office of the Commander and execute Notice to Proceed documents, and give performance and payment bonds on Government Standard forms 25 and 25A with good and sufficient surety. It is also requested that the successful bidder furnish insurance certificates required in SPECIAL CLAUSE titled "Required Insurance Schedule" at this time.

#### 1.32 UNEXPECTED HAZARDOUS SUBSTANCES

In the event that suspected hazardous substances are revealed during



construction activities, all such construction activities in the immediate area shall be immediately suspended. Hazardous substances for purposes of this specification only, shall be defined as CERCLA hazardous substances, infectious or radioactive wastes, asbestos or oil. The Contractor shall leave the materials undisturbed and shall immediately report the find to the Contracting Officer's Representative (COR) so that proper authorities can be notified. The Contractor shall not resume construction activities in the vicinity of the suspected hazardous substances until written clearance is received from the COR. Identification and removal of any such materials will be conducted in accordance with all Federal, state and local environmental laws and regulations according to the CONTRACT CLAUSE titled "Differing Site Conditions."

#### 1.33 SURVEY MARKERS

Reference is made to CONTRACT CLAUSE titled "Permits and Responsibilities", Chapter 60 of the Missouri Revised Statutes 1969, and rules titled "Maintenance of the Original US Public Land Survey Corners" adopted by the Division of Geology and Land Survey, Missouri Department of Natural Resources. The Contractor shall be responsible for removing and relocating survey markers. Relocation shall be performed by a professional registered Land Surveyor.

#### 1.34 DISPOSAL OF WASTE

: All construction and/or demolition waste shall be disposed of off-base in accordance with all applicable Federal, State and local regulations, including "Chapter 260, RSMO" of the "Missouri Department of Natural Resources."

#### 1.35 EXCAVATION NOTIFICATION

Prior to any excavation on either public or private properties, Missouri law requires that you notify all owners and operators of underground facilities in your dig site. Missouri One Call System (MOCS) can help you comply with the law; "Chapter 319, RSMO" of the "Missouri Department of Natural Resources," by calling this one toll-free number 1-800-344-7483.

#### 1.36 HOT WORK PERMIT

(a) The current Post Fire Regulations, AR 420-90, "Fire Prevention and Protection" and FLW Supplements to AR 420-90 are by this reference made a part of this solicitation and resultant contract. The Contractor's operations shall conform to all applicable portions of those documents. All personnel entering on duty as Contractor's employees shall be instructed in the fire prevention program of the Post and shall be advised of the requirement of the Post fire Regulations as they pertain to this particular contract.

(b) The Contractor shall obtain a written "Hot Work Permit" (DA Form 5383-R) prior to commencing all hot work outside an approved shop area. Permits will be issued by the Fort Leonard Wood Fire Department, (314) 596-0883, after all necessary precautions have been taken, such as wetting down the area, protection of combustible material, and positioning of first

aid fire extinguishers of proper type and class. Permits must be obtained in advance for use of open flame devices, such as blow torches, portable furnaces, tar kettles, or gas and electric welding and cutting equipment. Preparation and protection for such areas are the responsibility of the Contractor accomplishing the work. An inspection conducted by the Fire Department prior to commencing work may be required; however, the Contractor shall conduct an inspection of the area at least 30 minutes after completion of all work. The Contractor shall be liable for any fire loss to Government property attributable to negligence on the part of the Contractor, including failure to comply with fire prevention measures prescribed by terms of this contract.

(c) The Fire Prevention-Protection Division is responsible for monitoring the Contractor in the area of fire prevention and advising the Contracting Officer of all deficiencies. The Contracting Officer will alert the Contractor if a violation is a fire hazard or fire protection deficiency.

(d) This provision in no way authorizes anyone other than the Contracting Officer to commit the Government to changes in the terms of the contract.

#### 1.37 EROSION CONTROL PERMIT

Project site plans include minimum requirements for erosion control measures. They include, but are not limited to, siltation fences, siltation ponds, grading requirements and other measures. These measures represent the minimum required effort, as determined by designers, to preclude products of erosion from migrating beyond the limits of construction or into adjacent watercourses or streams. The Contractor shall provide this minimum effort and any further measures, implementing necessary best management practices for site specific requirements to comply with Federal, State and local laws and regulations. The Contractor shall prepare and submit a Storm Water Pollution Prevention Plan (SWPPP) which meets the specific requirements of the Missouri Department of Natural Resources' (MDNR) State Operating Permit No. MO-R101000, General Discharge Permit for Construction or Land Disturbance Activities. The erosion control measures/Best Management Practices contained in the Contractor's SWPPP shall be specific and shall be implemented in accordance with requirements of the MDNR General Permit. The Contractor shall implement additional Erosion Control Measures to address all exceedences. All fines levied by the regulatory agency are the responsibility of the Contractor. The contractor may request a deviation from said site plan requirements in writing to the Resident Engineer. In addition to such actions required to eliminate products or erosion from migrating off site, the Contractor shall be fully responsible and liable for all construction activities and their consequences. Compliance with environmental laws and regulations will not alleviate responsibility for damages that may be caused by contractor operations.

#### 1.38 UTILITY/DIGGING PERMITS POLICY

a) General. The Contractor must obtain an excavation permit from the Directorate of Public Works (DPW) prior to digging on Fort Leonard Wood. This allows for the proper marking of existing utilities, thereby preventing damages and outages to those utilities.

(b) Procedures. The Excavation Permit Request and the Utilities Flagging Request are one and the same. The contractor will use FLW Form 364 to initiate all flagging requests. A copy of FLW Form 364 is attached. The Contractor will be required to request flagging at least ten calendar days in advance of when he plans to dig in an area. He will indicate the area to be flagged, the resulting utility outage from this flagging effort, and the requirement date on the Excavation Permit which he submits to the Corps of Engineers Area Office (FM-WD). FM-WD turns the request over to the DPW on the same day as well. FM-WD and the DPW will both keep track of when the request was received and when the permit was issued. These dates will be reconciled at the weekly coordination meeting. It is the Contractor's responsibility to route the digging permit through the appropriate offices.

(1) The Contractor will be required to call 1-800-DIG-RITE to get the telephone company to mark its lines. This is in addition to the utilities to be marked by the DPW.

(2) The DPW, through its O&M contractor, will flag all other utilities and return the approved Excavation Permit to FM-WD. The Corps of Engineers QA representative and the Contractor will jointly mark up their individual contract drawings to document the flagging.

(3) Once the flagging is registered, the Contractor is responsible for replacing missing markings.

(4) If the utilities are not flagged within 10 calendar days of the submittal to the DOW, contract drawings will be used for showing utilities locations. Post utilities drawings will be used as backup.

(c) Accidental Cuts. If the utility is cut within a zone of 3 feet either side of the markings or, if there is no marking, the location shown on the drawings, the contractor will be required to repair the utility at his own expense. If the utility is cut outside of this 6-foot-wide zone, the DPW will be responsible for repairing the utility.

(d) Initial Flagging. **The Contractor will be required to include with his proposal a plan showing all areas to be excavated within the first fourteen calendar days of construction** This plan will be provided to the DPW and used to flag the required utilities to allow the Contractor to proceed with site work immediately upon contract award.

#### 1.39 MISSOURI SALES AND USE TAX

In accordance with FAR Clause 52.229, notice is given that the contract price excludes the Missouri sales tax and compensating (use) tax on all sales of tangible personal property and materials purchased by the Contractor or subcontractors for the construction of projects, including repairing or remodeling facilities, for the United States. In accordance with Section 144.062, RSMo., the Contracting Officer will issue and furnish to the Contractor an exemption certificate (example copy appears at the end of this section) for this project with the Notice to Proceed. The Contractor and the subcontractors will use the exemption certificate for this project in the purchase of supplies, materials and furnishings for incorporation in the project. The Contractor and the subcontractors shall furnish a copy of such certificate to all suppliers/materialmen from whom such purchases are made, and the suppliers shall execute invoices covering the same bearing the number of such certificate. (KCD OC)

## 1.40 INSTALLATION ACCESS DURING LABOR DISPUTES

(a) Subject to the limitations outlined in paragraphs (b) and (c), the Contractor may generally seek access to the installation for the performance of the contract utilizing any entrance to the installation open to public transportation.

(b) In case of labor unrest, including but not limited to strikes and informational pickets, the installation Garrison or Installation Commander has the right to implement a "reserve gate" plan. Pursuant to such a plan (1) the picketed contractor may be limited to the use of only one gate for all access on and off the installation; and (2) other contractors may be restricted from the use of the gate utilized by the Contractor(s) involved in the labor dispute. For purposes of this clause the term "picketed contractor" shall include all employees, subcontractors, suppliers, materialmen and agents of the contractor involved in the labor dispute.

(c) The choice of gate or gates to be utilized by the picketed Contractor(s) shall rest solely with the Garrison or Installation Commander based on the needs of the Government. Any delay or costs associated with the inability to use a particular entrance to the installation shall not be grounds for an equitable adjustment. Any entitlement to an extension of the performance period shall be determined pursuant to the Default Clause of the Contract.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

EXCAVATION PERMIT  
Fort Leonard Wood, Missouri  
(FLW Suppl I to AR 420-17)

REQUESTED BY: (Unit/Activity doing Excavation)

\_\_\_\_\_

POINT OF CONTACT NAME: \_\_\_\_\_ PHONE NUMBER: \_\_\_\_\_

DESCRIPTION AND LOCATION OF PROPOSED EXCAVATION: (Include a detailed map or drawing showing location.)

**GAS (NATURAL)**

Reviewer (Signature): \_\_\_\_\_ Date: \_\_\_\_\_

**EXTERIOR ELECTRICAL CONTRACTOR (High Voltage)**

Reviewer (Signature): \_\_\_\_\_ Date: \_\_\_\_\_

**DPW MAINTENANCE CONTRACTOR**

Heat/AG \_\_\_\_\_  
Water/Sewer \_\_\_\_\_  
Electrical (Secondary) \_\_\_\_\_  
Fuel \_\_\_\_\_

DIRECTOR OF PUBLIC WORKS: \_\_\_\_\_ Date: \_\_\_\_\_

**ARMY TELEPHONE (DOIM)**

Reviewer (Signature): \_\_\_\_\_ Date: \_\_\_\_\_

**SPRINT TELEPHONE COMPANY (Commercial)**  
**FOR APPROVAL CALL 1-800-DIG-RITE \*\*48 HOUR NOTICE\*\***

RANGE \_\_\_\_\_ TOWNSHIP \_\_\_\_\_ SECTION \_\_\_\_\_

Reviewer (Signature): \_\_\_\_\_ Date: \_\_\_\_\_

**SPRINT BARRACKS TELEPHONE COMPANY (Commercial)**

**FOR APPROVAL CALL 329-4603 OR 329-8200**

Reviewer (Signature): \_\_\_\_\_ Date: \_\_\_\_\_

**CABLE TV COMPANY**

**FOR APPROVAL CALL 336-5284 \*\*48 HOUR NOTICE\*\***

Reviewer (Signature): \_\_\_\_\_ Date: \_\_\_\_\_

**DOL (J-SIDDS)**

Reviewer (Signature): \_\_\_\_\_ Date: \_\_\_\_\_

**FINAL REVIEWER**

Final Reviewer (Signature): \_\_\_\_\_ Date: \_\_\_\_\_



ROUTING EXCAVATION PERMITS  
Points of Contact

OFFICE NAME	POC	BLDG #	TELEPHONE
Omega Pipeline Company (Natural Gas)	UTILICORP		1-800-282-4916
Vina Construction, Inc. (Exterior Electrical Contractor)	Mr. Ervin Williams	2272	596-0068
Rust Constructors, Inc. (DPW Maintenance Contractor)	MS Jeanne Barnett	2226	596-0074/0693
Directorate of Public Works, Work Management Branch ATZT-DPW-BW	Mr. Harold Campbell Mr. Gary Powell	2200	596-0926 596-1790 FAX 596-0868
Army Telephone (DOIM)	Mr. Bob Lewis MS Ida Allen	404	596-0681 FAX #6-1201
1-800-DIG-RITE (1-800-344-7483) Sprint Telephone Company			
Barracks Phone Service	Mr. Rick Vire	470	329-4603/8200 FAX 329-4586
Cable TV Company St. Robert	MS Susan Hall		336-5284 FAX 336-4556
J-SIDDS Commun/Electronics ATZT-DL-B-M-CE/DOL	Mr. Steve Page	5265	596-0874

EXAMPLE

STATE OF MISSOURI

PROJECT EXEMPTION CERTIFICATE FOR EXEMPT ENTITY CONSTRUCTION

UNITED STATES OF AMERICA

NAME OF EXEMPT ENTITY \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_ ZIP \_\_\_\_\_

TAX IDENTIFICATION NUMBER (None required)

PROJECT IDENTIFICATION NUMBER \_\_\_\_\_

PLEASE PROVIDE THE PROJECT LOCATION AND A BRIEF DESCRIPTION BELOW:

CONTRACT DATE \_\_\_\_\_

CERTIFICATE EXPIRATION DATE \_\_\_\_\_

Contractors are required to provide a copy of this project exemption certificate to their vendors.

This project exemption certificate does not allow contractors to purchase machinery, equipment, or tools used in fulfilling this contract, tax exempt.

Suppliers accepting this project exemption certificate are required to render to the contractor invoices bearing the name of the exempt entity and the project identification number.

An exempt entity that fails to revise the expiration date on this certificate as necessary to complete any work required by the contract will be liable for any sales tax determined due as a result of an audit of the contractor.

The Contractor shall provide this project exemption to all subcontractors purchasing construction materials for this project.

SIGNATURE OF AUTHORIZED AGENT

EXHIBIT A

-- End of Section --



## SECTION 01310

PROJECT SCHEDULE, NETWORK ANALYSIS SYSTEM (NAS)  
07/01

## PART 1 GENERAL

## 1.1 SCOPE

This section covers requirements for Contractor-prepared Network Analysis System (NAS), complete.

## 1.2 GENERAL

The progress chart to be prepared by the Contractor pursuant to the CONTRACT CLAUSE titled "Schedule For Construction Contracts" shall consist of a network analysis system (NAS) as described below. The scheduling of construction is the responsibility of the Contractor and contractor management personnel shall actively participate in development of the network logic diagram so that intended sequences and procedures are clearly understood. The Contractor shall provide the NAS in either Arrow Diagram Method (ADM) or Precedence (PDM) format. The network diagram required for each submission of the NAS shall depict the order and interdependence of activities and the method by which the work is to be accomplished. The approved Project Schedule shall be used to measure the progress of the work, to aid in evaluating time extensions, and provide the basis of all progress payments.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Data

Preliminary Network Diagram; GA-RE.

Initial Detailed Network Diagram; GA-RE.

Monthly Reports, Data and Diagrams; GA-RE.

- a. Logic Report
- b. Criticality Report
- c. Cost of Earned Value Report
- d. Summary Network Diagram

e. Narrative Report

f. SDEF Data Disk

#### 1.4 BASIS FOR PAYMENT

The schedule shall be the basis for measuring Contractor Progress. Lack of an approved schedule or scheduling personnel shall result in an inability of the Contracting officer to evaluate Contractor Progress for the purposes of payment. Failure of the Contractor to provide all information, as specified below shall result in the disapproval of the entire project Schedule submission and the inability of the Contracting officer to evaluate Contractor progress for payment purposes. In case where Project Schedule revisions have been directed by the Contracting Officer and those revisions have not been included in the Project Schedule, then the Contracting Officer may hold retainage up to the maximum allowed by contract, each payment period, until revisions to the Project Schedule have been made.

#### PART 2 PRODUCTS (Not Applicable)

#### PART 3 EXECUTION

##### 3.1 NETWORK ANALYSIS SYSTEM

###### 3.1.1 Preliminary Network Diagram

The Contractor shall submit within 10 calendar days of the NOTICE-TO-PROCEED a preliminary NAS schedule covering the first 90 days of operation. The preliminary schedule shall be used for payment not to exceed 60 days after notice to proceed.

###### 3.1.2 Initial Detailed NAS

The initial NAS shall be submitted within 40 calendar days after notice to proceed. It shall provide (1) a reasonable sequence of activities which represent work through the entire project and (2) a reasonable level of activity detail. Duration ranges for work activities shall generally be between three and twenty-two workdays. The schedule interval shall extend from notice to proceed through the contract duration specified in SPECIAL CLAUSE titled "Commencement, Prosecution, and Completion of Work" to contract completion date. Completion of the last activity in the schedule shall be constrained by the contract completion date such that if the projected finish of the last activity falls after the contract completion, then the float calculation shall reflect negative float. Interim milestone dates specified shall be so constrained also. Progress payments will be withheld until the Contractor submits an approvable schedule. Since it is understood that the contractor's logic and duration may change between the issuance of the Preliminary NAS and the Initial Detailed NAS, the Contracting Officer shall require a complete and comprehensive accounting of all modifications made to the Preliminary NAS to produce the Initial, Detailed NAS.

###### 3.1.3 Format of the Initial Detailed NAS

The diagram shall show a continuous activity flow from left to right. The diagrams shall be 36x48, minimum size unless explicitly modified by the Contracting Officer. The diagrams shall be legible, shall have activities 'grouped' or 'banded' by Project area, building or feature, and shall contain the following information:

- a. Activity number
- b. Activity description
- c. Duration in workdays
- e. Total float in workdays
- f. Logic ties
- h. Clearly marked critical path (s)
- i. 'Banded' or 'grouping' identification on each sheet
- j. Composed and/or milestone dates
- k. Scale of sufficiently large scale to render a legible diagram

Dates shall be shown on the diagram for start of the project, any milestones required by the contract, and contract completion. The critical path shall be clearly identified. Submittal, review, procurement, fabrication, delivery, installation, start-up, and testing of special or long lead-time materials and equipment shall be included in the NAS diagram. Government and other agency activities shall be shown. These include but are not limited to: notice to proceed, approvals, inspections, and utility tie in for phasing requirements.

Procurement Activities: Task related to the procurement of long lead materials or equipment shall be included as separate activities in the project schedule. Long lead materials and equipment are those materials that have a procurement cycle of over 90 days. Examples of procurement process activities include, but are not limited to: submittals, approval procurement, fabrications, and delivery.

#### a. Activity Identifier

The field known as the activity number or activity ID shall consist of numeric or alpha/numeric entries. Each major building, area or feature of the work shall have blocks of numbers set aside to identify each such feature. These numbers shall generally be ascending with procurement having the lower number sets, with ascending sets of numeric identifiers being applied to activities in the schedule by area, feature or building. Skip numbering shall be used in minimum increments off tens. The smallest set of numeric activity identifiers shall be used, with no spaces, left zero fills or other symbols to be used. The purpose of this requirement is to provide for simple, ascending activity numbers which will facilitate the computerized review and on-going use of the NAS database. The use of CSI codes, special account codes, identifiers or other matrices which the contractor may wish to use, or which are otherwise required herein, shall be input using data code fields other than the activity number/activity ID field.

#### b. Building, Area or Feature Codes

At least one alpha/numeric field in the scheduling software shall be used to provide a simple and clear identification of the building, area or feature

which is represented by the activity.

c. Artificial Schedule Constraints

The NAS shall contain no set dates other than those shown in the Contract. The contractor shall review with the Contracting Officer's Representative each proposed set date which the contractor proposes to include in the NAS and shall receive explicit approval for each closed date used in the NAS. The use of artificial float constraints such as 'Zero Free Float' or 'Zero Total Float' options are generally prohibited. The use of such features may be considered if fully justified by the contractor and explicitly approved by the Contracting Officer's Representative prior to its use in the NAS.

d. Other Software Options

If the contractor utilizes a scheduling software system which provides updating options such as 'Retained Logic' and 'Progress Override' the contractor shall use the 'Retained Logic' option for all updates to the NAS.

If the contractor desires to modify the approved NAS logic to correct out of-sequence work, the contractor shall make a request in writing to the Contracting Officer defining the desired modification(s). No unilateral modifications shall be made by the contractor to the approved NAS.

Actual Start and Finish Dates shall not be automatically updated by default mechanisms that may be included in CPM software systems. Actual Start and Finish dates on the CPM schedule shall match those dates provided from the Contractor Quality Control Reports. Failure of the Contractor to document the Actual Start and Finish Dates on the Daily Quality Control Report for every in-progress or completed activity and insure that the data contained on the Daily Quality Control Reports is the sole basis for schedule updating shall result in the disapproval of the Contractor's Schedule and the inability of the Contracting Officer to evaluate Contractor progress for payment purposes.

e. Resources

The contractor shall include in the NAS all major trades and equipment items required to construct the Project. The trades and major equipment items shall be identified by a unique code and the quantity of the resources shall be input into the scheduling software's 'resource' fields. Each Work activity shall have the planned resources identified as described above by specific trade type and/or equipment type. The resource file library and code listing shall be submitted by the contractor with the Initial, Detailed NAS, along with resource usage curves for each, individual resource code, shown by early and late usage as produced by the scheduling software database.

f. Negative Lags

Negative lags shall not be used in the contractor's NAS. If the contractor using PDM scheduling chooses to show-overlapping duration between related activities, start-to-start and finish-to-finish relationships shall be used,

with appropriate and justifiable lags. If ADM is used by the contractor, dummies shall have duration of zero.

g. Dangles

The only 'dangling' activities in the network shall be the beginning activity such as 'notice of award' or 'notice to proceed' and the ending activity such as 'contract complete'. A start and/or end 'dangle' is defined as an activity whose start is restrained only by the start date of the project or subproject, and/or whose finish is restrained only by the end date of the overall project or subproject.

h. Anticipated Weather

The contractor's 'holiday' or 'non-work day' file in the scheduling database shall have the anticipated lost weather days as listed herein input as non work days for each month of the calendar. This anticipated weather impact calendar should only be applied to activities which are subject to weather related delays.

3.1.4 Report Formats

The Contractor shall submit a reproducible and two copies of the network diagram at the initial and quarterly updates and three copies of the specified reports at the initial and every monthly update throughout the life of the project. The format of the reports shall contain: Activity Number(s), Activity description, Original Duration, Remaining Duration, Early Start date, Late Start date, Early Finish date, Late Finish date, and Total Float. The three report formats are listed below.

3.1.4.1 Logic Report

This report shall list all activities sorted according to activity number. Activities shall be printed in ascending order of activity number. Any standard report which lists all activities including restraints in this manner is acceptable. This report shall include the detail information related stated above and shall include and display the preceding and succeeding activities.

3.1.4.2 Criticality Report

This report shall list all activities sorted in ascending order of total float. Activities which have equal values of total float shall be listed in ascending order of Early Starts.

3.1.4.3 Cost of Earned Value Report

Cost and/or Earned Value reports shall contain Estimated Earned Value, Percent Complete (based on cost), and Earnings to Date. This report shall compile Contractor's total earned value on the project from the Notice to Proceed until the most recent monthly progress meeting based on agreed progress between the Contractor and the Contracting Officer. Provided that the Contractor has submitted a complete schedule update, this report shall serve as the basis for determining Contractor payment. When the Bidding

Schedule includes bid item(s), activities shall be grouped by bid item and then sorted by activity number(s). This report shall subtotal all activities in a bid item and provide a bid item percent complete and then total all bid items to provide a total project percent complete.

#### 3.1.4.4 Summary Network Diagram

A summary Bar Chart Network shall be submitted monthly. The summary bar chart shall be limited to 150 activities.

### 3.2 MONTHLY MEETINGS

A monthly meeting shall be conducted on site attended by the Contractor's project manager and appropriate Contracting Officer's representatives. During this meeting the Contractor shall describe, on an activity by activity basis, all proposed revisions and adjustments to the NAS required to reflect the current status of the project. The Contracting Officer's representative shall approve activity progress, proposed revisions and adjustments, and the use of any optional calculations. The following shall be addressed 3.2.1 Actual Start and Finish Dates

The actual start and actual finish dates for all activities in progress or completed as appropriate.

#### 3.2.2 Estimated Remaining Duration

The estimated remaining duration for each activity in progress. Progress calculations must be based on remaining duration for each activity and be in an approved calculation mode. The Estimated Remaining Duration shall not be tie-to the Earned Value.

#### 3.2.3 Earned Value

The earned value for each activity started but not completed. Payment shall be based on cost of completed activities plus cost to date of in progress activities.

#### 3.2.4 Logic Changes

All logic changes pertaining to change orders, on which a Notice to Proceed has been issued, Contractor proposed changes in activity sequence or duration, and corrections to schedule logic to avoid out of sequence progress. All logic changes shall be submitted for approval prior to their insertion into the approved NAS.

### 3.3 UPDATE OF NAS

Following the monthly progress meeting, a complete update of the NAS based on the approved progress, revisions, and adjustments agreed upon at the meeting shall be computed and submitted not later than 5 working days after the meeting. This update shall be subject to approval of the accurate entry of information agreed upon at the meeting. Actual starts and finishes, remaining duration, or percent complete shall not be automatically updated by default dates contained in many CPM scheduling software systems, except

that early start for an activity which could start prior to the update. Activities which have posted progress without predecessor activities being completed shall be allowed only on a case by case approval of the Contracting Officer's representative who may require logic changes to correct all such out of sequence progress. No unilateral modifications shall be made to the approved NAS without the explicit approval of the Contracting Officer.

### 3.4 NARRATIVE REPORT

A narrative report shall be provided with each update of the NAS. This report shall include (1) a description of activities and progress along the four most critical paths, (2) a description of a current and anticipated problem areas or delaying factors and their impact, and (3) an explanation of the corrective actions taken. Only modifications that have been authorized and approved by the Contracting Officer shall be included in the schedule sub-mission. The narrative report shall specifically reference, on an activity by activity basis all changes made since the previous period and relate each change to documented, approved schedule changes. This report, along with the progress update above, shall provide the basis for the Contractor's progress payment request, and the Contractor shall be entitled to progress payments determined from the currently approved NAS update. If the Contractor fails or refuses to furnish the information and NAS data which, in the sole judgment of the Contracting officer, is necessary for verifying the Contractor's progress, the Contractor shall be deemed not to have provided a progress payment estimate and progress payment will not be made.

### 3.5 TIME IMPACT "FRAGNET" ANALYSIS

Within twenty calendar days from the notice to proceed of a change, or from the start of the impact of a mutually recognized changed condition, whichever event occurs first, the contractor shall submit a detailed Time Impact 'fragnet' analysis to the Contracting Officer. The Time Impact 'fragnet' will clearly demonstrate all activities associated with the changed condition, including estimated durations, costs, resources and proposed tie-in points of the 'fragnet' into the approved NAS. Should the contractor fail to submit the 'fragnet' analysis within the expired time period as specified above, it shall be mutually agreed between the contractor and the Contracting officer that the changed condition has no time impact. The foregoing shall not be construed to limit the Contracting Officer's authority to issue unilateral modifications to the Contract as provided for herein.

### 3.6 EXTENSION OF CONTRACT COMPLETION DATE

In the event the Contractor requests an extension of the contract completion date for any other contractual reason, he shall furnish such justification as the Contracting Officer may deem necessary for a determination of the Contractor's right to an extension of time under the provisions of the contract. In such event, the schedule revisions must clearly display that the Contractor has used in full all available float time for the work involved with the request. Actual delays that are found to be caused by the Contractor's own actions or lack of action, and which result in the

extension of the projected contract completion date, shall not be cause for extension of the contract completion date. The Contracting Officer may find cause to extend the contract completion date under the contract in the absence of a request by the Contractor when, in the Contracting Officer's judgment, it is equitable.

### 3.7 EXTENSIONS OF TIME

Total Float is defined as the difference in time between the early start date and the late start date, or the difference between the early finish date and the late finish date. Total Float available in the schedule at any time shall not be considered as for exclusive use by either the Contractor or the Government. Extensions of time for performance of work required under CONTRACT CLAUSES titled, "Changes", "Differing Site Conditions", "Default (Fixed Price Construction)" or "Suspension of Work" will be granted only to the extent that equitable time adjustments for affected activities exceed the total float along their paths.

### 3.8 DATA DISC

A data disc shall be provided as required by paragraph: Scheduling System Data Exchange Format. The automated scheduling system utilized by the Contractor shall be capable of providing all requirements of this specification. As many data disk(s) as required in paragraph: Scheduling System Data Exchange Format shall be provided with the Preliminary Schedule, Initial schedule, Monthly Updates, and all NAS revisions or requests for revision.

### 3.9 SCHEDULING SYSTEM DATA EXCHANGE FORMAT

#### 3.9.1 Application of this Provision

The data exchange format provides a platform for exchanging scheduling and planning data between various software systems. The Data Exchange Format shall allow project management systems to share information with other programs e.g. Resident Management System (RMS). Scheduling information shall be transferred from the contractor's project management system to the Government as described in this section.

#### 3.9.2 Electronic Data Exchange File Required for All Schedule Submissions

##### 3.9.2.1 Schedule Data

The Contractor shall provide schedule data in the Data Exchange Format for each Preliminary, Initial, Monthly NAS Updates, and requests for time extensions or change proposals. The Contractor's failure to provide schedule data in the exact format described herein shall result in disapproval of the entire schedule submission.

##### 3.9.2.2 Transfer of Schedule Data

The entire set of schedule data shall be transferred at every exchange of scheduling data. Thus, for updates to existing projects, the data exchange file shall contain all activities that have not started or are already



complete as well as those activities in progress.

### 3.9.3 Data Transfer Responsibility

The Contractor shall be responsible for Electronic Data Exchange File data that may have been lost or destroyed during transit between the Contractor and the Contracting Officer. If Electronic Data Exchange File data is damaged during transit, then the Contractor shall provide the Contracting Officer with new Electronic Data Exchange File within two (2) working days of notification by the Contracting Officer.

### 3.9.4 Data Consistency Responsibility

The Contractor shall be responsible for the consistency between the Electronic Data Exchange File and printed reports which accompany schedule submissions. If Electronic Data Exchange File and printed reports which accompany schedule submission differs, in any way, from the printed schedule reports or standard activity coding, then the Contracting Officer shall disapprove the entire schedule submission.

The Contractor shall provide the Contracting Officer with a completely revised, and consistent, schedule submission within 24 hours of notification of inconsistency by the Contracting Officer.

### 3.9.5 Creating the Electronic Data Exchange File

The Contractor shall have the option of creating the electronic data exchange file by one of the three following methods.

#### 3.9.5.1 Commercially Available Software

The Contractor shall be required to secure software that meets this requirement. Many commercially available scheduling systems support the standard data exchange format. Under this option the Contractor shall produce his own data translation software. This software shall take the information provided by the Contractor's scheduling system and reformat the data into the Data Exchange Format.

#### 3.9.5.2 Interface Program

Under this option the Contractor shall produce his own data translation software. This software shall take the information provided by the Contractor's scheduling system and reformat the data into the Data Exchange Format.

#### 3.9.5.3 Manual Methods

Under this option the Contractor shall manually reformat his scheduling system report files or create all necessary data by manually entering all data into the Data Exchange Format.

### 3.9.6 File Transfer Medium

All required data shall be submitted on 3 ½" diskettes), formatted to hold

1.44 MB of data, under the MS-DOS version 5.0 (or higher) operating system. Higher data densities and other operating systems may be approved by the Contracting Officer if compatible with the Government's computing capability.

### 3.9.7 File Type and Format

The data file shall consist of a 132 character, fixed format, 'ASCII' file. Text shall be left justified and numbers shall be right justified in each field. Data records must conform, exactly, to the sequence column position, maximum length, mandatory values, and field definitions described below to comply with this standard data exchange format. Unless specifically stated, all numbers shall be whole numbers. All data columns shall be separated by a single blank column.

### 3.9.8 Electronic Data Exchange File Name

The Contractor shall insure that each file has a name related to either the schedule data date, project name, or contract number. No two Electronic Data Exchange Files shall have the same name through out the life of this contract. The Contractor shall submit his file naming convention to the Contracting Officer for approval. In the event that the Contractor's naming convention is disapproved, the Contracting Officer shall direct the contract to provide files under a unique file naming convention.

### 3.9.9 Disc Label

The Contractor shall affix a permanent exterior label to each diskette submitted. The label shall contain the type of schedule (Preliminary Initial, Update, or Change), full project number, project name, project location, data date, name and telephone number of the Contractor's scheduler, and the MS-DOS version used to format the diskette.

### 3.9.10 Standard Activity Coding Dictionary

The Contractor shall submit, with the initial schedule submission, a consistent coding scheme that shall be used throughout the project for the Activity Codes shown in paragraph: Activity Records of this section. The coding scheme submitted shall demonstrate that each code shall only represent one type of information through the duration of the contract. Incomplete coding of activities or an incomplete coding scheme shall be sufficient for disapproval of the schedule.

## 3.10 DATA EXCHANGE FILE FORMAT ORGANIZATION

The Data Exchange File Format shall consist of the following records provided in the exact sequence shown below:

#### Paragraph Record

Reference Description	Remarks
-----------------------	---------

#### Volume Record

First Record on Every Data Disk

#### Project ID Record

Second Record

#### Calendar Record(s)

Minimum of One Record Required

#### Holiday Record(s)

Optional Record

Activity Record(s)	Mandatory Record
Precedence Records	Mandatory for Precedence Method
Unit Cost Record(s)	Optional for Unit Cost Projection.
Progress Record(s)	Mandatory for Updates
File End Record	Last Record of Data File

### 3.10.1 Record Descriptions

#### 3.10.1.1 Volume Record

The Volume Record shall be used to control the transfer of data that may not fit on a single disk. The first record in every disk used to store the data exchange file shall contain the Volume Record. The Volume Record shall sequentially identify the number of the data transfer disk(s). The Volume Record shall have the following format:

Description	Column Position	Max Len.	Required. Value	Type	Just
RECORD IDENTIFIER	1- 4	4	VOLM	Fixed	
DISK NUMBER	6- 7	2	Number		Right

a. The RECORD IDENTIFIER is the first four characters of this record. The required value for this field shall be "VOLM".

b. The DISK NUMBER field shall identify the number of the data disk used to store the data exchange information. If all data may be contained on a single disk, this field shall contain the value of "1". If more disks are required, then the second designated with a "3", and so on. Identification of the last data disk shall not be accomplished with the Volume Record. Identification of the last data disk is accomplished in the PROJECT END RECORD (see paragraph: File End Record).

#### 3.10.1.2 Project ID Record

The Project ID Record is the second record of the file and shall contain project information in the following format:

Description	Column Position	Max. Len.	Required. Value	Type	Just
RECORD IDENTIFIER	1- 4	4	PROJ		Fixed
DATA DATE	6- 12	7	-	ddmmmyy	See(2)
PROJECT IDENTIFIER	14- 17	4	-	Alpha	Left
PROJECT NAME	19- 66	48	-	Alpha	Left
CONTRACTOR NAME	68-103	36	-	Alpha	Left
ARROW OR PRECEDENCE	105	1	A,P	Fixed	
CONTRACT NUMBER	107-112	6	-	Alpha	Left
PROJECT START	114-120	7	-	ddmmmyy	Filled
PROJECT END	122-128	7		ddmmmyy	Filled

a. The RECORD IDENTIFIER is the first four characters of this record. The required value for this field shall be "PROJ". This record shall contain the general project information and indicates which scheduling method shall

be used.

b. The DATA DATE is the date of the schedule calculation. The abbreviation "ddmmmyy" refers to a date format that shall translate a date into two numbers for the day, three letters for the month, and two numbers for the year. For example, March 1, 1999 shall be translated into 01MAR99. This same convention for date formats shall be used throughout the entire data format. To insure that dates are translated consistently, the following abbreviations shall be used for the three character month code:

Abbreviation	Month
JAN	January
FEB	February
MAR	March
APR	April
MAY	May
JUN	June
JUL	July
AUG	August
SEP	September
OCT	October
NOV	November
DEC	December

c. The PROJECT IDENTIFIER is the maximum of four-character abbreviation for the schedule. These four characters shall be used to uniquely identify the project and specific update as agreed upon by the Contractor and Contracting Officer. When utilizing scheduling software these four characters shall be used to select the project. Software manufacturers' shall verify that data importing programs do not automatically overwrite other schedules with the same PROJECT IDENTIFIER.

d. The PROJECT NAME field shall contain the name and location of the project edited to fit the space provided. The data appearing here shall appear on scheduling software reports. The abbreviation "Alpha" used throughout paragraph six, RECORD DESCRIPTIONS, refers to an Alphanumeric field value.

e. The CONTRACTOR NAME field shall contain the Construction Contractor's name edited to fit the space provided.

f. The ARROW OR PRECEDENCE field shall indicate which method shall be used for calculation of the schedule. The value "A" shall signify the Arrow Diagramming Technique. The value "P" shall signify the Precedence Diagramming Technique. The ACTIVITY IDENTIFICATION field of the Activity Record shall be interpreted differently depending on the value of this field (see paragraph 3.10.1.5 b). The Precedence Record shall be required if the value of this field is "P" (see paragraph 3.10.1.5).

g. THE CONTRACT NUMBER field shall directly identify the contract for the project. For example, a complete Government construction contract number, "DACA41-98-C-0001" shall be entered into this field as "980001".

h. The PROJECT START shall contain the date that the project will start or has started. On Government construction projects, this date is the date that the construction contractor acknowledges the Notice to Proceed.

i. The PROJECT END shall contain the data that the contract must complete on or prior to. On Government construction projects, this date is the PROJECT START plus the contract period, typically expressed in a specific number of calendar days.

### 3.10.1.3 Calendar Record

The Calendar Record(s) shall follow the Project Identifier Record in every data file. A minimum of one Calendar Record shall be required for all data exchange activity files. The format for the Calendar Record shall be as follows:

Description	Column Position	Max Len.	Required. Value	Type	Just.
RECORD IDENTIFIER	1-4	4	CLDR		Fixed
CALENDAR CODE	6-6	1	-	Alpha.	Filled
WORKDAYS	8-14	7		SMTWTFS	See (3)
CALENDAR DESCRIPTION	16-45		30	Alpha.	Left

a. The RECORD IDENTIFIER shall always begin with "CLDR" to identify it as a Calendar Record. Each Calendar Record used shall have this identification in the first four columns.

b. The CALENDAR CODE shall be used in the activity records to signify that this calendar is associated with the activity.

c. The WORKDAYS field shall contain the work week pattern selected with "Y" for Yes, and "N" for No. The first character shall be Sunday and the last character Saturday. An example of a typical five-(5) day workweek would be NYYYYYN. A seven-(7) day workweek would be YYYYYYY.

d. The CALENDAR DESCRIPTION shall be used to briefly explain the calendar used. optional Holiday Record(s) shall follow the Calendar record(s). The Holiday Record shall be used to designate specific non-work days for a specific Calendar. More than one Holiday Record may be used for a particular calendar. If used, the following format shall be followed:

Description	Column Position	Max. Len.	Required. Value	Type	Just.
RECORD IDENTIFIER	1-4	4	HOLI		Fixed
CALENDAR CODE	6-6	1	-	Alpha.	Filled
HOLIDAY DATE	8-14	7	-	ddmmmyy	Filled
HOLIDAY DATE	16-22	7	-	ddmmmyy	Filled
HOLIDAY DATE	24-30	7	-	ddmmmyy	Filled
HOLIDAY DATE	32-38	7	-	ddmmmyy	Filled
HOLIDAY DATE	40-46	7	-	ddmmmyy	Filled
HOLIDAY DATE	48-54	7	-	ddmmmyy	Filled

HOLIDAY	DATE	56-62	7	-	ddmmmyy	Filled
HOLIDAY	DATE	64-70	7	-	ddmmmyy	Filled
HOLIDAY	DATE	72-78	7	-	ddmmmyy	Filled
HOLIDAY	DATE	80-86	7	-	ddmmmyy	Filled
HOLIDAY	DATE	88-94	7	-	ddmmmyy	Filled
HOLIDAY	DATE	96-102	7	-	ddmmmyy	Filled
HOLIDAY	DATE	104-110	7	-	ddmmmyy	Filled
HOLIDAY	DATE	112-118	7	-	ddmmmyy	Filled
HOLIDAY	DATE	120-126	7	-	ddmmmyy	Filled

a. The RECORD IDENTIFIER shall always begin with "HOLI" and shall signify an Optional Holiday Calendar is to be used.

b. The CALENDAR CODE indicates which work week calendar the holidays shall be applied to. More than one HOLI record may be used for a given CALENDAR CODE.

c. The HOLIDAY DATE is to be used for each date to be designated as a non-work day.

#### 3.10.1.4 Activity Records

Activity Records shall follow any Holiday Record(s). If there are no Holiday Record(s), then the Activity Records shall follow the Calendar Record(s). There shall be one Activity Record for every activity in the network. Each activity shall have one record in the following format:

Description	Column Position	Max. Len.	Required. Value	Type	Just.
RECORD IDENTIFIER	1-4	4	ACTV		Fixed
ACTIVITY IDENTIFICATION	6-15	10			See(2)
ACTIVITY DESCRIPTION	17-46	30		Alpha.	Left
ACTIVITY DURATION	48-50	3		Integer	Right
CONSTRAINT DATE	52-58	7		ddmmmyy	Filled
CONSTRAINT TYPE	60-61	2			See(7)
CALENDAR CODE	63-63	1		Alpha.	Filled
HAMMOCK CODE	65-65	1	Y.	blank	Fixed
WORKERS PER DAY	67-69	3		Integer	Right
RESPONSIBILITY CODE	71-74	4		Alpha.	Left
WORK AREA CODE	76-79	4		Alpha.	Left
MOD OR CLAIM NUMBER	81-86	6		Alpha.	Left
BID ITEM	88-93	6		Alpha.	Left
PHASE OF WORK	95-96	2		Alpha.	Left
CATEGORY OF WORK	98-98	1		Alpha.	Filled
FEATURE OF WORK	100-129	30		Alpha.	Left

a. The RECORD IDENTIFIER for each activity description record must begin with the four-character "ACTV" code. This field shall be used for both the Arrow Diagram Method (ADM) and Precedence Diagram Method (PDM) (see paragraph: Activity Records).

b. The ACTIVITY IDENTIFICATION consists of coding that differs, depending

on whether the ADM or PDM method was selected in the Project Record (see paragraph: Project ID Record). If the ADM method was selected, then the field shall be interpreted as two right justified fields of five (5) integers each. If the PDM method was selected, the field shall be interpreted as one (1) right-justified field of ten (10) integers or alpha/numeric characters. The maximum activity number allowed under this arrangement is 99999 for ADM and 9999999999 for the PDM method.

c. The ACTIVITY DESCRIPTION shall be a maximum of 30 characters. Descriptions must be limited to the space provided.

d. The ACTIVITY DURATION contains the estimated duration for the activity on the schedule. The duration shall be based upon the workweek designated by the activity's related calendar. Reasonable durations are required to allow progress of activities to be accurately determined between payment periods. A rule of thumb the Contractor should use is less than 2 percent of all non-procurement activities' Original Durations shall be greater than 22 workdays.

e. The CONSTRAINT DATE field shall be used to identify a date that the scheduling system may use to modify float calculations. If there is a date in this field, then there must be a valid entry in the CONSTRAINT TYPE field. The CONSTRAINT DATE shall be the same as, or later than, the PROJECT START DATE. The CONSTRAINT DATE shall be the same as, or earlier than, the PROJECT END DATE.

f. The CONSTRAINT TYPE field shall be used to identify the way that the scheduling system shall use the CONSTRAINT DATE to modify schedule float calculations. If there is a value in this field, then there must be a valid entry in the CONSTRAINT DATE TYPE. Other types may be available from specific software manufacturers.

#### Code      Definition

ES      The CONSTRAINT DATE shall replace an activity's early start date, if the early start date is prior to the CONSTRAINT DATE.

LF      The CONSTRAINT DATE shall replace an activity's late finish date, if the late finish date is after the CONSTRAINT DATE.

g. The CALENDAR CODE, as previously explained, relates this activity to an appropriate workweek calendar. The ACTIVITY DURATION must be based on the valid workweek referenced by this CALENDAR CODE field.

h. The HAMMOCK CODE indicates that a particular activity does not have its own independent duration, but takes its start dates from the start date of the preceding activity (or node) and takes its finish dates from the finish dates of its succeeding activity (or node). If the value of the HAMMOCK ACTIVITY field is "Y", then the activity is a HAMMOCK ACTIVITY.

i. The WORKERS PER DAY. This field may contain the average number of workers expected to work on the activity each day the activity is in progress. The total duration times the average number of workers per day shall equal the contractor's estimate of the total man days of work required

to perform the activity.

j. The RESPONSIBILITY CODE shall identify the Subcontractor or major trade involved with completing the work for the activity.

k. The WORK AREA CODE shall identify the location of the activity within the project.

l. The MOD OR CLAIM NUMBER CODE. This code shall be use to uniquely identify activities that are changed on a construction contract modification, or activities that justify any claimed time extensions.

m. The BID ITEM field shall designate the bid item number associated with the activity. The values of all the various activities shall sum to the amount stated in the Contract Bid Item Schedule.

n. The PHASE OF CONSTRUCTION shall designate phase to which an activity is connected. This field shall used for submittals, procurement, fabrication, site work or building or areas within a building, etc..

o. The CATEGORY OF WORK shall be from the following list:

CODE      DESCRIPTION

A	Architectural
C	Civil
E	Electrical
F	Fire Extinguish
H	Hazardous/Toxic
M	Mechanical
P	Plumbing
R	Roofing
S	Structural
T	Safety
X	Administrative

p. The FEATURE OF WORK shall match those in the Resident Management system that is to be used on this project. See the attached RMS data Sheets listing some examples of the features of work at the End of this Section.

### 3.10.1.5 Precedence Record

The Precedence Record(s) shall follow the Activity Records if a Precedence Type Schedule (PDM) is identified in the ARROW OR PRECEDENCE field of the Project Record (see paragraph: Project ID Record). The Precedence Record has the following format:

Description	Column Position	Max. Len.	Required. Value	Type	Just.
RECORD IDENTIFIER	1-4	4	PRED		Fixed
ACTIVITY IDENTIFICATION	6-15	10	-	Integer	See (2)
PRECEDING ACTIVITY	17-26	10	-	Integer	
PREDECESSOR TYPE	28-28	1	S,F,C		Filled



LAG DURATION                      30-33                      4                      -                      Integer                      Right

a.            The RECORD IDENTIFIER shall begin with the four characters "PRED" in the first four columns of the record.

b.            The ACTIVITY IDENTIFICATION identifies the activity whose predecessor shall be specified in this record. Refer to the Activity Record for further explanation on this field (see paragraph 3.10.1.4 b.).

c.            The PREDECESSOR ACTIVITY number is the number of an activity that precedes the activity noted in the ACTIVITY IDENTIFICATION field.

d.            The PREDECESSOR TYPE field indicates the type of relationship that exists between the chosen pair of activities. The PREDECESSOR TYPE field must, as minimum, contain one of the codes listed below. Other types of activity relations may be supported from specific software vendors.

Code      Definition

S      Start-to-Start relationship  
F      Finish-to-Finish relationship  
C      Finish-to-Start relationship

e.            The LAG DURATION field contains the number of day's delay between the preceding and current activity.

### 3.10.1.6      Unit Cost Record

The Unit Cost Record shall follow all Precedence Records. If the schedule utilizes the Arrow Diagram Method, then the Unit Cost Record shall follow any Activity Records. The fields for this record shall take the following format:

Description	Column Position	Max. Len.	Required. Value	Type	Just.
RECORD IDENTIFIER	1-4	4		UNIT	Fixed
ACTIVITY IDENTIFICATION	6-15	10	-	Integer	See (2)
TOTAL QTY	17-29	13	-	8.4	Right
COST PER UNIT	31-43	13	-	8.4	Right
QTY TO DATE	45-57	13	-	8.4	Right
UNIT OF MEASURE	59-61	3	-	Alpha.	Left

a.            The RECORD IDENTIFIER shall be identified with the four characters "UNIT" placed in the first four columns of the record.

b.            The ACTIVITY IDENTIFICATION for each activity shall match the format described in the activity record (see paragraph 3.10.1.4 b.).

c.            The TOTAL QTY is the total amount of this type of material to be used in this activity. This number consists of eight digits, one decimal point, and four more digits. An example of a number in this format is 111111111.1111". If decimal places are not needed, this field shall still contain a ".0000" in columns 25, 26, 27, 28 and 29.

d. The COST PER UNIT is the cost, in dollars and cents, for each unit to be used in this activity. This number consists of eight digits, one decimal point, and four more digits. An example of a number in this format is "11111111.1111". If decimal places are not needed, this field shall still contain an ".0000" in columns 38, 39, 41, 42 and 43.

e. The QTY TO DATE is the quantity of material installed in this activity up to the data date. This number consists of eight digits, one decimal point, and four more digits. An example of a number in this format is "11111111.1111". If decimal places are not needed, this field shall still contain a ".0000" in columns 53, 54, 55, 56, and 57.

f. The UNIT OF MEASURE is an abbreviation that may be used to describe the units being measured for this activity.

### 3.10.1.7 Progress Record

Progress Record(s) shall follow all Unit Cost Record(s). If there are no Unit Cost Record(s), then the Progress Record(s) shall follow all Precedence Records. If the schedule utilizes the Arrow Diagram Method, then the Progress Record shall follow any Activity Records. One Record shall exist for each activity in-progress or completed. The fields for this Record shall take the following format:

Description	Column Position	Max. Len.	Required. Value	Type	Just.
RECORD IDENTIFIER	1- 4	4	PROG		Fixed
ACTIVITY IDENTIFICATION	6- 15	10	-	Integer	See (2)
ACTUAL START DATE	17- 23	7	-	ddmmmyy	Full
ACTUAL FINISH DATE	25- 31	7	-	ddmmmyy	Full
REMAINING DURATION	33- 35	3	-	Integer	Right
ACTIVITY COST	37- 48	12	-	9.2	Right
COST TO DATE	50- 61	12	-	9.2	Right
STORED MATERIAL	63- 74	12	-	9.2	Right
EARLY START DATE	75- 82	7	-	ddmmmyy	
EARLY FINISH DATE	84- 90	7	-	ddmmmyy	
LATE START DATE	92- 98	7	-	ddmmmyy	
LATE FINISH DATE	100-106	7	-	ddmmmyy	
FLOAT SIGN	108-108	1	+,-		Fixed
TOTAL FLOAT	110-112	3	-	Integer	Right

a. The RECORD IDENTIFIER shall begin with the four characters "PROG" in the first four columns of the record.

b. The ACTIVITY IDENTIFICATION for each activity for which progress has been posted, shall match the format described in the Activity Record (see paragraph 3.10.4(b)).

c. The ACTUAL START DATE is required for all in-progress activities. The ACTUAL START DATE shall be the same as, or later than, the PROJECT START DATE contained in the Project Record (see paragraph 3.10.2(h)). The ACTUAL

START DATE shall also be the same as, or prior to, the DATA DATE contained in the Project Record.

d. An ACTUAL FINISH DATE is required for all completed activities. If the REMAINING DURATION of an activity is zero, then there must be an ACTUAL FINISH DATE. The ACTUAL FINISH DATE must be the same as, or later than the PROJECT START date contained in the Project Record .(see paragraph 3.10.2(h)). The ACTUAL FINISH DATE must also be the same as, or prior to the DATA DATE contained in the Project Record.

e. REMAINING DURATION is required for all in-progress activities. Activities completed, based on time, shall have a zero (0) REMAINING DURATION

f. Cost Progress is contained in the field COST TO DATE. If there is an ACTUAL START DATE, then there must also be some value for COST TO DATE. The COST TO DATE shall not be tied to REMAINING DURATION. For example, if the REMAINING DURATION is "0", the COST TO DATE may only be 95% of the ACTIVITY COST. This difference may be used to reflect 5% retainage for punch list items.

#### 3.10.1.8 File End Record

The File End Record shall be used to identify that the data file is completed. This record shall be the last record of the entire data file. The File End Record shall have the following format:

Description	Column Position	Max. Len.	Required. Value	Type	Just.
RECORD IDENTIFIER	1- 33		END		Fixed

a. The RECORD IDENTIFIER for the File End Record shall be "End". No data contained in the data exchange file that occurs after this record is found shall be used.

#### 3.10.2 Transfer of Data into the Resident Management System (RMS)

The Contractor shall also be responsible for the downloading and uploading of the schedule data into the Resident Management System (RMS) that will be used on the subject Contract prior to the RMS databases being transferred to the Government as part of the monthly and final payment requests.

#### 3.10.3 Features of Work Listings for RMS

The following Features of Work are to be typed as shown into the schedule as it applies to the project. The Feature of Work may have to be broken down as required in the software package selected to be used for obtaining the one 30 character field for the SDEF data exchange.

A/C SYSTEM, UNITARY TYPE  
ACCESS FLOORING SYSTEM  
ACOUSTICAL TREATMENT, CEILINGS  
ADMINISTRATION & MOBILIZATION

ARCH FURNISHINGS, INT/EXT  
ASBESTOS ABATEMENT  
ASPHALT PAVING  
BUILDER'S HARDWARE  
BUILDING INSULATION-RIGID/BATT  
CAISSONS & PILING  
CARPENTRY - FINISH  
CARPENTRY - ROUGH  
CASEWORK  
CAULKING & SEALANTS  
CENTRAL REFRIGERATION SYSTEM  
ACOUSTICAL TREATMENT, WALLS  
COMMUNICATION SYSTEM, PREWIRE  
CONCRETE CURBS, GUTTERS, S/W  
CONCRETE, CAST-IN-PLACE  
CONTAMINATED DEBRIS REMOVAL  
CONTRACT MODIFICATIONS, ADMIN  
DAMPROOFING / WATERPROOFING  
DEMOLITION  
DEMOUNTABLE PARTITIONS  
DIESEL GENERATORS  
DOORS - ACCORDIAN & PARTITION  
DOORS - HOLLOW METAL & FRAMES  
DOORS - REVOLVING  
DOORS - SLIDING ALUMINUM  
DOORS - VAULT, SECURITY  
DOORS - WOOD & FRAMES  
DRYWALL  
EARTHWORK - AGG BASE COURSE  
EARTHWORK - BORROW AND FILL  
EARTHWORK - EXCAVATION  
EARTHWORK - GRADING  
EARTHWORK - RIPRAP  
ELECTRICAL, A.T.S. & BP/ISO SW  
ELECTRICAL, AERIAL  
ELECTRICAL, HAZARDOUS AREAS  
ELECTRICAL, INT PNLBDS & SWGR  
ELECTRICAL, INTERIOR - FINISH  
ELECTRICAL, INTERIOR - LT FIXT  
ELECTRICAL, INTERIOR - ROUGH  
ELECTRICAL, LIGHTNING PROTECTN  
ELECTRICAL, PRIMRY SWGR & DIST  
ELECTRICAL, UNDERGROUND  
ELEVATOR SYSTEM  
ENERGY MONITORING CNTRL SYSTEM  
ENVIRONMENTAL PROTECTION  
EVAPORATIVE COOLING SYSTEM  
EXTERIOR CEMENT BOARD SYSTEM  
FENCING & GATES  
FINAL INSPECTION  
FIRE DETECTION & ALARM SYSTEMS  
FIRE SPRINKLER SYS, UNDERGRND  
FIRE SPRINKLER SYS, INTERIOR  
FIREPROOFING

FLOOR COVERING, CARPET  
FLOOR COVERING, RESILIENT  
FOOD SERVICE EQUIPMENT  
FORMWORK, STRUCTURAL CONCRETE  
FUEL OIL SYSTEMS  
GAS PIPING SYSTEM, INTERIOR  
GLASS & GLAZING  
HEATING SYSTEM, HOT AIR & STM  
HOT WATER HEATING SYSTEM  
HTW LIQUID DISPOSAL  
HTW LIQUID REMOVAL  
HTW LIQUID TRANSPORTATION  
HTW LIQUID TREATMENT  
HTW SOIL DISPOSAL  
HTW SOIL TRANSPORTATION  
HTW SOIL TREATMENT  
HTW SOIL REMOVAL  
HVAC CONTROL SYSTEMS  
HVAC DUCTWORK SYSTEM  
HVAC SYSTEMS  
INSTRUMENTATION  
IRRIGATION SYSTEM  
LABORATORY EQUIPMENT  
LANDSCAPING  
LATH AND PLASTERING  
LATH AND STUCCO  
MASONRY  
METAL DECKING  
METAL FRAMING  
METAL STUDS  
MISC METALS-CANPS, SCUT, EXP JTS  
OIL/WATER SEPARATOR  
PAINTING, SEALERS AND STAINS  
PAVING, RIGID  
PLUMBING, INTERIOR - ROUGH  
PLUMBING, INTERIOR - TRIM  
POL/WASTE OIL TANK  
PRECAST ARCHITECTURAL CONCRETE  
RADIO & PUBLIC ADDRESS SYSTEM  
ROLLUP/COILING, SHTRS/DRS/GRLS  
ROOFING, BUILT-UP  
ROOFING, METAL  
SALVAGE  
SEISMIC PROT FOR MECH & ELECT  
SHEETMETAL WORK, ARCHITECTURAL  
SIGNAGE, EXTERIOR  
SIGNAGE, INTERIOR  
SOIL REMEDIATION  
SOIL TREATMENT  
STEEL JOISTS  
STRUCTURAL STEEL  
SYSTEMS FURNITURE  
TANK REMOVAL, ABOVE-GROUND  
TANK REMOVAL, UNDERGROUND

TELEPHONE SYSTEM, EXTERIOR  
TELEPHONE SYSTEM, INTERIOR  
TEST AND BALANCE, AIR & WATER  
THERMAL INSULATION, MECH SYS  
THERMAL INSULATION, PIPING SYS  
TILE, CERAMIC  
TILE, QUARRY  
TILE, TERRAZZO  
TOILET PARTITIONS/ACCESSORIES  
U.G. SITE - GAS  
U.G. SITE - SEWER  
U.G. SITE - STORM  
U.G. SITE - WATER  
WALL COVERINGS  
WATER TREATMENT EQUIP & SYSTEM  
WELLS, EXTRACTION  
WELLS, MONITORING  
WELLS, WATER  
WINDOW WALLS AND DOORS  
WINDOWS  
WINDOW COVERINGS  
X-RAY SHIELDING  
FIRESTOPPING  
EARTHWORK - CLEARING & GRUBBNG  
HOISTS AND CRANES  
U.G. SITE - MECHANICAL  
LEAD ABATEMENT  
PLAYGROUND SAFETY SURFACING  
PLAYGROUND EQUIPMENT  
FOUNDATION PREPARATION  
EXCAVATION (UTILITIES)  
EARTHWORK-EXCAVATION TRENCHING  
EXT/INT STEEL STUDS & DRYWALL

-- End of Section --

SECTION 01330

SUBMITTAL PROCEDURES  
**09/97**

PART 1 GENERAL

1.1 SUBMITTAL IDENTIFICATION

Submittals required are identified by SD numbers as follows:

SD-01 Preconstruction Submittals

SD-02 Shop Drawings

SD-03 Product Data

SD-04 Samples

SD-05 Design Data

SD-06 Test Reports

SD-07 Certificates

SD-08 Manufacturer's Instructions

SD-09 Manufacturer's Field Reports

SD-10 Operation and Maintenance Data

SD-11 Closeout Submittals

1.2 SUBMITTAL CLASSIFICATION

Within the terms of the Contract Clause entitled "Specifications and Drawings for Construction," the following are considered to be "shop drawings" and are classified as follows:

1.2.1 Government Approved

Governmental approval is required for extensions of design, critical materials, deviations, equipment whose compatibility with the entire system must be checked, and other items as designated by the Contracting Officer.

1.2.2 Information Only

All submittals not requiring Government approval will be for information only.

### 1.3 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals shall not be construed as a complete check, but will indicate only that the general method of construction, materials, detailing and other information are satisfactory. Approval will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor under the Contractor Quality Control (CQC) requirements of this contract is responsible for dimensions, the design of adequate connections and details, and the satisfactory construction of all work. After submittals have been approved by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

### 1.4 DISAPPROVED SUBMITTALS

The Contractor shall make all corrections required by the Contracting Officer and promptly furnish a corrected submittal in the form and number of copies specified for the initial submittal. **CAUTION** The Contractor is cautioned that for each Contractor's resubmittal required beyond the initial submittal and one resubmittal for corrections required by the Contracting Officer, the Contracting Officer will assess Administrative Deduction in the amount of \$780.00 from the progress payments due the Contractor. If the Contractor considers any correction indicated on the submittals to constitute a change to the contract, a notice in accordance with the Contract Clause "Changes" shall be given promptly to the Contracting Officer.

### 1.5 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

## PART 2 PRODUCTS (Not Applicable)

## PART 3 EXECUTION

### 3.1 GENERAL

The Contractor shall make submittals as required by the specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Units of weights and measures used on all submittals shall be the same as those used in the contract drawings. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements. Prior to submittal, all items shall be checked and approved by the Contractor's Quality Control (CQC) System Manager and each item shall be stamped, signed, and dated by the CQC System Manager indicating action taken. Proposed deviations from the contract requirements shall be clearly identified. Submittals shall include items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals. Submittals requiring Government approval shall be



scheduled and made prior to the acquisition of the material or equipment covered thereby. Samples remaining upon completion of the work shall be picked up and disposed of in accordance with manufacturer's Material Safety Data Sheets (MSDS) and in compliance with existing laws and regulations.

### 3.2 SUBMITTAL REGISTER (ENG FORM 4288)

At the end of this section is one set of ENG Form 4288 listing items of equipment and materials for which submittals are required by the specifications; this list may not be all inclusive and additional submittals may be required. The Contractor will also be given the submittal register files, containing the computerized ENG Form 4288 thru the Resident Management System (RMS). Columns "d" through "r" have been completed by the Government; the Contractor shall complete columns "a" and "s" through "u" through the RMS System and submit the forms (hard copy plus associated electronic file) to the Contracting Officer for approval. The Contractor shall keep the RMS System up-to-date and shall submit it to the Government together with the monthly payment request. The approved submittal register will become the scheduling document and will be used to control submittals throughout the life of the contract. The submittal register and the progress schedules shall be coordinated through the RMS System.

### 3.3 SCHEDULING

Submittals covering component items forming a system or items that are interrelated shall be scheduled to be coordinated and submitted concurrently. Certifications to be submitted with the pertinent drawings shall be so scheduled. Adequate time (a minimum of forty-five (45) calendar days exclusive of mailing time) shall be allowed and shown on the register for review and approval. No delay damages or time extensions will be allowed for time lost in late submittals.

### 3.4 TRANSMITTAL FORM (ENG FORM 4025)

The sample transmittal form (ENG Form 4025) attached to this section shall be used for submitting both Government approved and information only submittals in accordance with the instructions on the reverse side of the form. These forms will be furnished to the Contractor. This form shall be properly completed by filling out all the heading blank spaces and identifying each item submitted as inputted RMS System. Special care shall be exercised to ensure proper listing of the specification paragraph and/or sheet number of the contract drawings pertinent to the data submitted for each item.

### 3.5 SUBMITTAL PROCEDURE

Submittals shall be made as follows:

#### 3.5.1 Procedures

##### 3.5.1.1 Contractor Submittals

The Contractor shall submit for approval six (6) copies of all submittals.

### 3.5.1.2 Military Projects

For all Military projects an additional copy of all submittals (for information only) related to fire protection/detection systems shall be submitted to the Directorate of Public Works Office for review by the Fire Chief. The mailing address for these submittals shall be as follows:

Directorate of Public Works, AZTZ-DPW-F  
Attn: Fire Chief  
1334 First Street  
Ft. Leonard Wood, Missouri 65473-8944

### 3.5.1.3 All Other Submittals

Items not to be submitted in quintuplicate, such as samples and test cylinders, shall be submitted accompanied by Six (6) copies of ENG Form 4025 and one (1) copy of ENG Form 4026. The distribution of the submittals shall be as follows for the Reviewer column of the ENG Form 4288

#### GA-AO

Six (6) copies of ENG Form 4025  
Ft. Leonard Wood Area Office  
P.O. Box 200  
1334 First Street, DPW Complex, Building 2204  
Ft. Leonard Wood, Missouri 65473-0200

#### GA-BK OR GA-SKC

Five (5) copies of the ENG Form 4025 and one (1) copy of ENG Form 4026  
One (1) copy of the ENG Form 4025 to FM-WD  
US Army Engineer District, Kansas City  
Federal Building, 601 East 12th Street, EC-DS (or EC-GL)  
Kansas City, Missouri 64106-2896

#### GA-CH, GA-DN, GA-HQ, OR GA-SAB

Four (4) copies of the ENG Form 4025 and one (1) copy of ENG Form 4026  
One (1) copy of the ENG Form 4025 to FM-WD  
One (1) copy of the ENG Form 4025 to EC-DS  
ATKINS BENHAM  
9400 North Broadway  
Oklahoma City, OK 73114-7401

### 3.5.2 Deviations

For submittals which include proposed deviations requested by the Contractor, the column "variation" of ENG Form 4025 shall be checked. The Contractor shall set forth in writing the reason for any deviations and annotate such deviations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted deviations.

### 3.6 CONTROL OF SUBMITTALS

The Contractor shall carefully control his procurement operations to ensure that each individual submittal is made on or before the Contractor scheduled submittal date shown on the approved "Submittal Register."

### 3.7 GOVERNMENT APPROVED SUBMITTALS

Upon completion of review of submittals requiring Government approval, the submittals will be identified as having received approval by being so stamped and dated. Four (4) copies of the submittal will be retained by the Contracting Officer and one (2) copy of the submittal will be returned to the Contractor.

### 3.8 INFORMATION ONLY SUBMITTALS

Normally submittals for information only will not be returned. Approval of the Contracting Officer is not required on information only submittals. The Government reserves the right to require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

### 3.9 STAMPS

Stamps used by the Contractor on the submittal data to certify that the submittal meets contract requirements shall be similar to the following:

CONTRACTOR

(Firm Name)

\_\_\_\_\_ Approved

\_\_\_\_\_ Approved with corrections as noted on submittal data and/or  
attached sheets(s).

SIGNATURE: \_\_\_\_\_

TITLE: \_\_\_\_\_

DATE: \_\_\_\_\_

-- End of Section --



## INSTRUCTIONS

1. Section I will be initiated by the Contractor in the required number of copies.
2. Each transmittal shall be numbered consecutively in the space provided for "Transmittal No.". This number, in addition to the contract number, will form a serial number for identifying each submittal. For new submittals or resubmittals mark the appropriate box; on resubmittals, insert transmittal number of last submission as well as the new submittal number.
3. The "Item No." will be the same "Item No." as indicated on ENG FORM 4288-R for each entry on this form.
4. Submittals requiring expeditious handling will be submitted on a separate form.
5. Separate transmittal form will be used for submittals under separate sections of the specifications.
6. A check shall be placed in the "Variation" column when a submittal is not in accordance with the plans and specifications--also, a written statement to that effect shall be included in the space provided for "Remarks".
7. Form is self-transmittal, letter of transmittal is not required.
8. When a sample of material or Manufacturer's Certificate of Compliance is transmitted, indicate "Sample" or "Certificate" in column c, Section I.
9. U.S. Army Corps of Engineers approving authority will assign action codes as indicated below in space provided in Section I, column i to each item submitted. In addition they will ensure enclosures are indicated and attached to the form prior to return to the contractor. The Contractor will assign action codes as indicated below in Section I, column g, to each item submitted.

### THE FOLLOWING ACTION CODES ARE GIVEN TO ITEMS SUBMITTED

- |   |   |
|---|---|
| A -- Approved as submitted.   | E -- Disapproved (See attached).  |
| B -- Approved, except as noted on drawings.   | F -- Receipt acknowledged.  |
| C -- Approved, except as noted on drawings.<br>Refer to attached sheet resubmission required. | FX -- Receipt acknowledged, does not comply<br>as noted with contract requirements. |
| D -- Will be returned by separate correspondence.   | G -- Other ( <i>Specify</i> )   |

10. Approval of items does not relieve the contractor from complying with all the requirements of the contract plans and specifications.

# SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

BCT Trainee Complex

CONTRACTOR

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02300	SD-03 Product Data														
			Earthwork		FIO												
			SD-06 Test Reports														
			Testing	3.13	FIO												
			SD-07 Certificates														
			Testing	3.13	FIO												
		02315	SD-06 Test Reports														
			Testing	3.14	FIO												
		02316	SD-06 Test Reports														
			Field Density Tests	3.4.3	FIO												
			GA-AO		FIO												
			Testing of Backfill Materials	3.4.2	FIO												
		02510	SD-06 Test Reports														
			Bacteriological Disinfection	3.3.1	FIO												
			SD-08 Manufacturer's Instructions														
			Installation	3.1	FIO												
			Waste Water Disposal Method		FIO												
			GA-AO		FIO												
			Satisfactory Installation		FIO												
			SD-07 Certificates														
			Manufacturer's Representative	1.4	FIO												
			Installation	3.1	FIO												
			Meters	2.9.8	FIO												
		02531	SD-07 Certificates														
			Portland Cement		FIO												
		02555	SD-02 Shop Drawings														

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02555	Distribution System		FIO												
			GA-AO		FIO												
			SD-03 Product Data														
			Distribution System		FIO												
			GA-AO		FIO												
			SD-07 Certificates														
			Distribution System		FIO												
			Welding Procedures and Operators		FIO												
			SD-10 Operation and Maintenance Data														
			Distribution System		FIO												
			GA-AO		FIO												
		02570	SD-02 Shop Drawings														
			Valve Manholes, Pipe, and Equipment		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-04 Samples														
			Insulated Sections		FIO												
			GA-AO		FIO												
			SD-10 Operation and Maintenance Data														



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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION		DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02570	Valve Manholes, Pipe, and Equipment		FIO												
		02620	SD-07 Certificates														
			Filter Fabric	2.2	FIO												
			Pipe for Subdrains	2.1	FIO												
		02630	SD-07 Certificates														
			Resin Certification	2.1.8	FIO												
			Resin Certification	2.1.9	FIO												
			Hydrostatic Test on Watertight Joints	2.7	FIO												
			Determination of Density	3.7.5	FIO												
			Frame and Cover for Gratings	2.3.7	FIO												
			SD-08 Manufacturer's Instructions														
			Placing Pipe	3.3	FIO												
		02712	SD-03 Product Data														
			Equipment, Machines, and Tools	1.5	FIO												
			GA-AO		FIO												
			SD-06 Test Reports														
			Field Density	3.5.2	FIO												
			SD-07 Certificates														
			Lime		FIO												
			GA-AO		FIO												
			Source		FIO												
			SAMPLING AND TESTING	3.4	FIO												
		02714	SD-06 Test Reports														
			Sampling and Testing	1.8	FIO												

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02714	GA-AO		FIO												
			Approval of Materials	1.8.5	FIO												
			Evaluation	3.2.7	FIO												
		02721	SD-03 Product Data														
			Equipment	1.7	FIO												
			SD-06 Test Reports														
			Sampling and Testing	1.5	FIO												
		02722	SD-03 Product Data														
			Plant, Equipment, and Tools	1.7	FIO												
			SD-06 Test Reports														
			Sampling and testing	1.5	FIO												
			GA-AO		FIO												
			Field Density Tests	1.5.2.4	FIO												
		02731	SD-03 Product Data														
			Equipment	1.5	FIO												
			SD-06 Test Reports														
			Sampling and Testing	1.6	FIO												
			Density Tests	3.12	FIO												
		02741	SD-04 Samples														
			Asphalt Cement Binder	2.2	FIO												
			GA-AO		FIO												
			Aggregates	2.1	FIO												
			SD-06 Test Reports														
			Aggregates	2.1	FIO												
			GA-AO		FIO												
			QC Monitoring	3.10.3.10	FIO												

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION		DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02741	SD-07 Certificates														
			Asphalt Cement Binder	2.2	FIO												
			GA-AO		FIO												
			Testing Laboratory		G AO												
			Mix Design	2.3	FIO												
			Contractor Quality Control	3.10	FIO												
			Material Acceptance and Percent Payment		FIO												
		02748	SD-06 Test Reports														
			Tests		FIO												
		02754	SD-03 Product Data														
			Equipment	1.7	FIO												
			Paving	3.4	G RE												
			Mixture Proportions	2.11	G KC												
		02760	SD-03 Product Data														
			Manufacturer's Recommendations		G												
			Construction Equipment List		FIO												
			FIO, RE		FIO												
			SD-04 Samples														
			Materials		G												
		02763	SD-03 Product Data														
			Equipment Lists		FIO												
			GA-AO		FIO												
			SD-06 Test Reports														
			Material Tests		FIO												
			SD-07 Certificates														

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(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02763	Volatile Organic Compound (VOC) Content		FIO												
			SD-08 Manufacturer's Instructions Mixing, Thinning and Application Qualifications		FIO FIO												
		02770	SD-03 Product Data														
			Concrete	2.1	FIO												
			Color Mixer		FIO												
			SD-06 Test Reports														
			Field Quality Control	3.8	FIO												
		02832	SD-02 Shop Drawings														
			Shop Drawings		FIO												
			GA-KC		FIO												
			SD-03 Product Data														
			Manufacturer's Data		FIO												
			Test Data		FIO												
			Calculations		FIO												
			GA-KC		FIO												
			SD-04 Samples														
			Segmental Concrete Units		FIO												
			GA-RE		FIO												
			Reinforcement		FIO												
			SD-07 Certificates														
			Certificate of Compliance		FIO												
			Qualifications		FIO												
		02833	SD-03 Product Data														

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION		DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02833	Item Covered by Submittal		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-07 Certificates														
			GA-AO		FIO												
		02921	SD-03 Product Data														
			Equipment		FIO												
			GA-SAB		FIO												
			Surface Erosion Control Material	2.8	FIO												
			Chemical Treatment Material	1.4.3	FIO												
			Delivery	1.4.1	FIO												
			Finished Grade and Topsoil	3.2.1	FIO												
			Topsoil	2.2	FIO												
			Quantity Check	3.5	FIO												
			Seed Establishment Period	3.9	FIO												
			Maintenance Record	3.9.3.5	FIO												
			Application of Pesticide	3.6	FIO												
			SD-04 Samples														
			Delivered Topsoil	1.4.1.1	FIO												
			Soil Amendments	2.3	FIO												
			Mulch	2.4	FIO												
			SD-06 Test Reports														
			Equipment Calibration	3.1.3	FIO												
			Soil Test	3.1.4	FIO												

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						SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION		DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION	
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		02921	GA-SAB		FIO												
			SD-07 Certificates														
			Seed	2.1	FIO												
			GA-SAB		FIO												
			Topsoil	2.2	FIO												
			pH Adjuster	2.3.1	FIO												
			Fertilizer	2.3.2	FIO												
			Organic Material	2.3.4	FIO												
			Soil Conditioner	2.3.5	FIO												
			Mulch	2.4	FIO												
			Asphalt Adhesive	2.5	FIO												
			Pesticide	2.7	FIO												
		02930	SD-02 Shop Drawings														
			Shop Drawings		FIO												
			GA-AO		FIO												
			SD-03 Product Data														
			Chemical Treatment Material		FIO												
			SD-04 Samples														
			Delivered Topsoil	1.4.1.3	FIO												
			Soil Amendments		FIO												
			Mulch	2.4	FIO												
			Geotextile		FIO												
			Plant Establishment Period	3.9	FIO												
			GA-AO		FIO												
			SD-06 Test Reports														
			Soil Test	3.1.4.2	FIO												

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		02930	GA-AO		FIO												
			Percolation Test	3.1.4.1	FIO												
			SD-07 Certificates														
			Plant Material	2.1	FIO												
			GA-AO		FIO												
			Topsoil	2.2	FIO												
			pH Adjuster	2.3.1	FIO												
			Fertilizer	2.3.2	FIO												
			GA		FIO												
			Organic Material	2.3.3	FIO												
			Soil Conditioner	2.3.4	FIO												
			Organic Mulch	2.4.2	FIO												
			I		FIO												
			Pesticide	2.14	FIO												
			SD-10 Operation and Maintenance														
			Data														
			Maintenance Instructions	3.9.5	FIO												
			GA-AO		FIO												
		03100	SD-02 Shop Drawings														
			Concrete Formwork		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-03 Product Data														
			Form Materials	2.1	FIO												

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		03100	GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-05 Design Data														
			Design	1.3	FIO												
			SD-08 Manufacturer's Instructions														
			Form Releasing Agents	2.1.7	FIO												
		03150	SD-02 Shop Drawings														
			Waterstops	2.4	FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-03 Product Data														
			Preformed Expansion Joint Filler	2.2	FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Sealant	2.3	FIO												
			Waterstops	2.4	FIO												
			SD-04 Samples														
			Preformed Compression Seals and Lubricants		FIO												
			Field-Molded Type	2.3.4	FIO												



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		03150	Non-metallic Materials	2.4.3	FIO												
			SD-07 Certificates														
			Preformed Expansion Joint Filler	2.2	FIO												
			Sealant	2.3	FIO												
			Waterstops	2.4	FIO												
			SD-08 Manufacturer's Instructions														
			Preformed Expansion Joint Filler	2.2	FIO												
			Sealant	2.3	FIO												
			Waterstops	2.4	FIO												
		03200	SD-02 Shop Drawings														
			Concrete Reinforcement System		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-07 Certificates														
			Reinforcing Steel	2.3	FIO												
			SD-08 Manufacturer's Instructions														
			Welding	1.3	FIO												
		03300	SD-04 Samples														
			Surface Retarder	2.3.5	FIO												
			SD-05 Design Data														
			Mixture Proportions	1.9	FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												

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		03300	GA-HQ		FIO												
			SD-06 Test Reports														
			Testing and Inspection for	3.17	FIO												
			Contractor Quality Control														
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-07 Certificates														
			Qualifications	1.5	FIO												
		04200	SD-02 Shop Drawings														
			Masonry Work		FIO												
			GA-RE		FIO												
			SD-03 Product Data														
			Clay or Shale Brick	2.2	FIO												
			GA-RE		FIO												
			Insulation		G												
			SD-04 Samples														
			Concrete Masonry Units (CMU)	2.4	FIO												
			GA-RE		FIO												
			Stone Items		FIO												
			Clay or Shale Brick	2.2	FIO												
			Anchors, Ties, and Bar	2.12	FIO												
			Positioners														
			Expansion-Joint Material		FIO												
			Joint Reinforcement	2.13	FIO												

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		04200	Insulation		FIO												
			Portable Panel		FIO												
			SD-06 Test Reports														
			Efflorescence Test	3.26.3	FIO												
			GA-RE		FIO												
			Field Testing of Mortar	3.26.1	FIO												
			Field Testing of Grout	3.26.2	FIO												
			Prism tests	3.26.4	FIO												
			Masonry Cement		FIO												
			Special Inspection		G												
			SD-07 Certificates														
			Clay or Shale Brick	2.2	FIO												
			Concrete Masonry Units (CMU)	2.4	FIO												
			Control Joint Keys		FIO												
			Anchors, Ties, and Bar Positioners	2.12	FIO												
			Expansion-Joint Materials	2.16	FIO												
			Joint Reinforcement	2.13	FIO												
			Reinforcing Steel Bars and Rods	2.14	FIO												
			Masonry Cement		FIO												
			Mortar Coloring		FIO												
			Insulation		FIO												
			Precast Concrete Items	2.8	FIO												
			Mortar Admixtures		FIO												
			Grout Admixtures		FIO												
			Insulation;		FIO												

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		04200	GA-RE		FIO												
			SD-08 Manufacturer's Instructions														
			Cold Weather Installation	3.1.2	G												
		04220	SD-02 Shop Drawings														
			Masonry Veneer/Steel Stud Wall		FIO												
			System														
			GA-BK		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-04 Samples														
			Expansion Joint Materials		FIO												
			GA-BK		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Brick		FIO												
			Concrete Masonry Units		FIO												
			Sample Panel		FIO												
			GA-CH		FIO												
			SD-06 Test Reports														
			Masonry Veneer/Steel Stud Wall		FIO												
			System														
			SD-07 Certificates														
			Brick		FIO												
			Expansion Joint Materials		FIO												
			Insulation		FIO												
			Gypsum Sheathing		FIO												

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		04220	Veneer Anchors		FIO												
			Welders Qualification		FIO												
		05090	SD-07 Certificates														
			Welding Procedure Qualifications	1.5	FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Welder, Welding Operator, and Tacker Qualification	1.6	FIO												
			Inspector Qualification	1.7	FIO												
			Previous Qualifications	1.5.1	FIO												
			Prequalified Procedures	1.5.2	FIO												
			Quality Control	3.2	FIO												
		05120	SD-01 Preconstruction Submittals														
			Erection	3.2	FIO												
			Welding	3.3	FIO												
			Welding	3.3	FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-02 Shop Drawings														
			Structural Steel System		FIO												
			GA-BK		FIO												
			GA-CH		FIO												

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		05120	GA-DN		FIO												
			GA-HQ		FIO												
			Structural Connections	3.2.1	FIO												
			SD-04 Samples														
			High Strength Bolts and Nuts	2.5	FIO												
			Carbon Steel Bolts and Nuts	2.6	FIO												
			Nuts Dimensional Style	2.7	FIO												
			Washers	2.8	FIO												
			SD-07 Certificates														
			Mill Test Reports		FIO												
			Welder Qualifications		FIO												
			Welding Inspector	1.5	FIO												
			Fabrication	3.1	FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
		05210	SD-02 Shop Drawings														
			Steel Joists		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-07 Certificates														
			Steel Joists		FIO												
		05300	SD-03 Product Data														

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		05300	Deck Units	2.1	FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-02 Shop Drawings														
			Deck Units	2.1	FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Accessories	2.5	FIO												
			Attachments		FIO												
			Holes and Openings	3.4	FIO												
			SD-07 Certificates														
			Deck Units	2.1	FIO												
			Attachments		FIO												
			Welder qualifications	3.3	FIO												
		05400	SD-02 Shop Drawings														
			Cold-Formed Steel Framing		FIO												
			GA-BK		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-07 Certificates														
			Mill Certificates		FIO												
			Welding Certificates		FIO												

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		05500	SD-02 Shop Drawings														
			Miscellaneous Metal Items		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
		06100	SD-07 Certificates														
			Grading and Marking	2.1.1	FIO												
			Insulation	2.3	FIO												
		06410	SD-02 Shop Drawings														
			Casework		FIO												
			GA-HQ		FIO												
			GA-DN		FIO												
			GA-BK		FIO												
			SD-03 Product Data														
			GA-HQ		FIO												
			GA-DN		FIO												
			GA-BK		FIO												
			SD-04 Samples														
			Plastic laminate		FIO												
			GA-HQ		FIO												
			GA-DN		FIO												
			GA-BK		FIO												
			Cabinet hardware		FIO												
		07220	SD-07 Certificates														
			Insulation	2.2	FIO												



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		07220	SD-08 Manufacturer's Instructions														
			Application of Insulation	3.7	FIO												
		07240	SD-04 Samples														
			Exterior Insulation and Finish System		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-06 Test Reports														
			Exterior Insulation and Finish System		FIO												
			SD-08 Manufacturer's Instructions														
			Exterior Insulation and Finish System		FIO												
			Manufacturer's Approval and License		FIO												
		07416	SD-02 Shop Drawings														
			Structural Standing Seam Metal Roof System		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-03 Product Data														
			Design Analysis		FIO												

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		07416	GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-04 Samples														
			Accessories	2.3	FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Roof Panels	2.1	FIO												
			Factory Color Finish	2.6	FIO												
			Fasteners	2.4	FIO												
			Insulation	2.7	FIO												
			Gaskets and Insulating Compounds	2.10	FIO												
			Sealant	2.9	FIO												
			Concealed Anchor Clips	2.2	FIO												
			Subpurlins	2.5	FIO												
			EPDM Rubber Boots	2.12	FIO												
			External attachments		FIO												
			SD-06 Test Reports														
			Test Report for Uplift Resistance of the SSSMR		FIO												
			GA-BK		FIO												
			GA-DN		FIO												

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		07416	GA-CH		FIO												
			GA-HQ		FIO												
			SD-07 Certificates														
			Structural Standing Seam Metal Roof System		FIO												
			Insulation	2.7	FIO												
			SD-08 Manufacturer's Instructions Qualifications		FIO												
		07530	SD-02 Shop Drawings														
			Roofing System		FIO												
			GA-RE		FIO												
			SD-07 Certificates Materials		FIO												
			SD-08 Manufacturer's Instructions Installation		FIO												
		07600	SD-02 Shop Drawings														
			Materials	2.1	FIO												
			GA-RE		FIO												
		07840	SD-02 Shop Drawings														
			Firestopping Materials	2.1	FIO												
			GA-RE		FIO												
			SD-07 Certificates Firestopping Materials	2.1	FIO												
			Installer Qualifications	1.5	FIO												
			Inspection	3.3	FIO												
		07900	SD-03 Product Data														

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		07900	Backing	2.1	FIO												
			Bond-Breaker	2.2	FIO												
			Sealant	2.5	FIO												
			SD-07 Certificates														
			Sealant	2.5	FIO												
		08110	SD-02 Shop Drawings														
			Doors	2.1	FIO												
			Doors	2.1	FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Frames	2.7	FIO												
			Frames	2.7	FIO												
			Accessories	2.5	FIO												
			SD-03 Product Data														
			Doors	2.1	FIO												
			Frames	2.7	FIO												
			Accessories	2.5	FIO												
		08120	SD-02 Shop Drawings														
			Aluminum Doors and Frames		FIO												
			GA-BK		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-03 Product Data														
			Aluminum Doors and Frames		FIO												

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		08120	GA-BK		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-04 Samples														
			Finishes	2.1.1	FIO												
			GA-BK		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-06 Test Reports														
			Aluminum Doors		FIO												
			SD-08 Manufacturer's Instructions														
			Installation	3.1.2	FIO												
			Cleaning		FIO												
		08210	SD-02 Shop Drawings														
			Wood Doors and Frames		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Fire Doors	3.1.2	FIO												
			SD-04 Samples														
			Factory Coated Natural Finish	2.8.1	FIO												
			GA-BK		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-07 Certificates														

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		08210	Fire Rated Doors	2.4	FIO												
			Adhesives		FIO												
		08330	SD-02 Shop Drawings														
			Overhead Rolling Door Unit		FIO												
			GA-SAB		FIO												
			GA-CH		FIO												
			SD-03 Product Data														
			Overhead Rolling Door Unit		FIO												
			GA-SAB		FIO												
			GA-CH		FIO												
			SD-04 Samples														
			Overhead Rolling Door Unit		FIO												
			GA-SAB		FIO												
			GA-CH		FIO												
			SD-08 Manufacturer's Instructions														
			Overhead Rolling Door Unit		FIO												
			SD-10 Operation and Maintenance Data														
			Operation Manual		FIO												
			Maintenance and Repair Manual		FIO												
		08331	SD-02 Shop Drawings														
			Approved Detail Drawings	3.1	FIO												
			GA-HQ		FIO												
			SD-03 Product Data														
			Rolling Counter Doors		FIO												
			Installation	3.1	FIO												

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		08331	Cleaning	3.3	FIO												
			SD-10 Operation and Maintenance Data														
			Operation	2.5	FIO												
		08353	SD-02 Shop Drawings														
			Accordion Partitions	2.2	FIO												
			GA-BK		FIO												
			SD-03 Product Data														
			Accordion Partitions	2.2	FIO												
			GA-BK		FIO												
			SD-04 Samples														
			Accordion Partitions	2.2	FIO												
			SD-07 Certificates														
			Accordion Partitions	2.2	FIO												
			SD-10 Operation and Maintenance Data														
			Accordion Partitions	2.2	FIO												
		08361	SD-02 Shop Drawings														
			Sectional Overhead Doors		FIO												
			GA-CH		FIO												
			SD-03 Product Data														
			Doors	2.2	FIO												
			Electric operators		FIO												
			SD-08 Manufacturer's Instructions														
			Doors	2.2	FIO												

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		08361	SD-10 Operation and Maintenance														
			Data														
			Doors	2.2	FIO												
		08520	SD-02 Shop Drawings														
			Windows	2.1	FIO												
			GA-BK		FIO												
			GA-HQ		FIO												
			SD-03 Product Data														
			Windows	2.1	FIO												
			GA-HQ		FIO												
			GA-BK		FIO												
			Hardware	2.2.7.1	FIO												
			Fasteners	2.2.7.2	FIO												
			SD-04 Samples														
			Finish Sample	1.4.2.1	FIO												
			Window Sample	1.4.2.2	FIO												
			SD-05 Design Data														
			Structural calculations for deflection	2.1	FIO												
			GA-HQ		FIO												
			GA-BK		FIO												
			SD-06 Test Reports														
			Minimum condensation resistance factor	1.4.4	FIO												
		08700	SD-02 Shop Drawings														
			Hardware Devices		FIO												



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		08700	GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			GA-SAB		FIO												
			Hardware Schedule		FIO												
			Keying Schedule		FIO												
			SD-03 Product Data														
			Hardware and Accessories		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			GA-SAB		FIO												
			SD-07 Certificates														
			Hardware and Accessories		FIO												
		08810	SD-02 Shop Drawings														
			Glazing Materials and Accessories		FIO												
			SD-03 Product Data														
			Glass		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Glazing Accessories		FIO												

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		08810	SD-04 Samples														
			Glass		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-07 Certificates														
			Glass		FIO												
		09250	SD-07 Certificates														
			Exterior Sheathing Board		FIO												
			Fire-Rated Gypsum Board	2.4.2	FIO												
			Impact Resistant Gypsum Board		FIO												
			Sound Attenuation Insulation		FIO												
			Shaftwall Liner Panel		FIO												
		09310	SD-03 Product Data														
			Tile	2.1	FIO												
			Mortar, Grout, and Adhesive		FIO												
			SD-04 Samples														
			Tile	2.1	FIO												
			GA-BK		FIO												
			GA-HQ		FIO												
			GA-DN		FIO												
			GA-CH		FIO												
			Accessories		FIO												
			Marble Thresholds	2.5	FIO												
			SD-07 Certificates														

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		09310	Tile	2.1	FIO												
			Mortar, Grout, and Adhesive		FIO												
			GA-BK		FIO												
			GA-HQ		FIO												
			GA-DN		FIO												
			GA-CH		FIO												
			SD-08 Manufacturer's Instructions														
			Tile	2.1	FIO												
			Mortar and Grout		FIO												
		09510	SD-02 Shop Drawings														
			Acoustical Ceiling System		FIO												
			GA-BK		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			GA-CH		FIO												
			SD-03 Product Data														
			Acoustical Ceiling System		FIO												
			GA-BK		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			GA-CH		FIO												
			SD-04 Samples														
			Acoustical Units	2.1	FIO												
			GA-BK		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												

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		09510	GA-CH		FIO												
			SD-06 Test Reports														
			Ceiling Attenuation Class and Test	2.8	FIO												
			GA-KC		FIO												
			GA-BK		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			GA-CH		FIO												
			SD-07 Certificates														
			Acoustical Units	2.1	FIO												
		09521	SD-02 Shop Drawings														
			Acoustical Wall System		FIO												
			GA-HQ		FIO												
			GA-BK		FIO												
			SD-03 Product Data														
			Acoustical Wall System		FIO												
			GA-HQ		FIO												
			GA-BK		FIO												
			SD-04 Samples														
			Acoustical Wall System		FIO												
			GA-HQ		FIO												
			GA-BK		FIO												
			SD-08 Manufacturer's Instructions														
			Manufacturer's descriptive data, catalog cuts		FIO												

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		09521	GA-HQ		FIO												
			GA-BK		FIO												
			Installation Instructions		FIO												
			Maintenance		FIO												
		09650	SD-03 Product Data														
			Resilient Flooring and		FIO												
			Accessories														
			GA-BK		FIO												
			GA-DN		FIO												
			GA-CH		FIO												
			GA-HQ		FIO												
			SD-04 Samples														
			Resilient Flooring and		FIO												
			Accessories														
			GA-BK		FIO												
			GA-DN		FIO												
			GA-CH		FIO												
			GA-HQ		FIO												
			SD-06 Test Reports														
			Resilient Flooring and		FIO												
			Accessories														
			GA-BK		FIO												
			GA-DN		FIO												
			GA-CH		FIO												
			GA-HQ		FIO												
		09680	SD-02 Shop Drawings														

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		09680	Installation	3.4	FIO												
			GA-HQ		FIO												
			Molding	2.3	FIO												
			SD-03 Product Data														
			Carpet		FIO												
			GA-HQ		FIO												
			Surface Preparation	3.1	FIO												
			Installation	3.4	FIO												
			Regulatory Requirements	1.3	FIO												
			SD-04 Samples														
			Carpet		FIO												
			GA-HQ		FIO												
			Molding	2.3	FIO												
			SD-06 Test Reports														
			Moisture and Alkalinity Tests	3.2	FIO												
			GA-HQ		FIO												
			SD-07 Certificates														
			Carpet		FIO												
			GA-HQ		FIO												
			SD-10 Operation and Maintenance														
			Data														
			Carpet		FIO												
			Cleaning and Protection	3.5	FIO												
		09720	SD-03 Product Data														
			Wallcoverings	2.1	FIO												
			GA-DN		FIO												

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		09720	GA-HQ		FIO												
			Manufacturer's Instructions	3.2	FIO												
			Installation	3.3	FIO												
			Maintenance	1.6	FIO												
			Clean-Up	3.4	FIO												
			SD-04 Samples														
			Wallcoverings	2.1	FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-07 Certificates														
			Wallcoverings	2.1	FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
		09900	SD-03 Product Data														
			Paint	2.1	FIO												
			SD-04 Samples														
			Moisture-Curing Polyurethane		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Paint	2.1	FIO												
			SD-06 Test Reports														
			Paint	2.1	FIO												
			GA-BK		FIO												
			GA-CH		FIO												

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		09900	GA-DN		FIO												
			GA-HQ		FIO												
			SD-07 Certificates														
			Lead	2.1.3	FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Mildewcide and Insecticide	2.1.2	FIO												
			Volatile Organic Compound (VOC) Content	2.1.5	FIO												
			SD-08 Manufacturer's Instructions														
			Mixing and Thinning	3.3	FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Application	3.4	FIO												
		09910	SD-03 Product Data														
			Acrylic Wallcoating		FIO												
			GA-KCD		FIO												
			SD-04 Samples														
			Acrylic Wallcoating		FIO												
			GA-KCD		FIO												
			SD-06 Test Reports														
			Testing		FIO												



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TITLE AND LOCATION

BCT Trainee Complex

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	GOVT CLASSIFICATION OR REVIEW NUMBER	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION		DATE FWD TO APPR AUTH/  DATE RCD FROM CONTR	APPROVING AUTHORITY				MAILED TO CONTR/  DATE RCD FRM APPR AUTH	REMARKS
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		09910	GA-KCD		FIO												
			SD-07 Certificates														
			Installer Qualifications		FIO												
			GA-RE		FIO												
			SD-08 Manufacturer's Instructions														
			Installation		FIO												
			GA-RE		FIO												
			Maintenance		FIO												
		09911	SD-02 Shop Drawings														
			Submittal Drawings		FIO												
			GA-BK		FIO												
			SD-03 Product Data														
			Manufacturer's Literature		FIO												
			SD-04 Samples														
			Panel Assembly		FIO												
			GA-BK		FIO												
			Finish		FIO												
			SD-07 Certificates														
			Requirements Affidavit		FIO												
		09920	SD-04 Samples														
			Color board		FIO												
			GA-KCD (One Set) GA-RE (Two		FIO												
			Sets)														
		09930	SD-02 Shop Drawings														
			Shop Drawings		FIO												
			GA-KC		FIO												

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		09930	SD-03 Product Data														
			Product Data		FIO												
			GA-KC		FIO												
			SD-04 Samples														
			Product Samples		FIO												
			GA-KC		FIO												
			Sample Color Chips		FIO												
			SD-08 Manufacturer's Instructions														
			Design Mixes		FIO												
			GA-KC		FIO												
		10100	SD-03 Product Data														
			Visual Display Boards		FIO												
			GA-BK		FIO												
			GA-HQ		FIO												
			SD-08 Manufacturer's Instructions														
			GA-BK		FIO												
			GA-HQ		FIO												
			Visual Display Boards		FIO												
			SD-07 Certificates														
			GA-BK		FIO												
			GA-HQ		FIO												
			Visual Display Boards		FIO												
			SD-04 Samples														
			GA-BK		FIO												
			GA-HQ		FIO												
			Aluminum		FIO												

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		10100	Porcelain Enamel Materials		FIO												
		10160	SD-02 Shop Drawings Toilet Partition System GA-BK GA-DN GA-HQ GA-CH		FIO												
			SD-03 Product Data Toilet Partition System GA-BK GA-DN GA-HQ GA-CH		FIO												
			SD-04 Samples Toilet Partition System GA-DN GA-BK GA-HQ GA-CH		FIO												
		10180	SD-02 Shop Drawings Shop Drawings GA-BK GA-HQ		FIO												
			SD-03 Product Data Product Literature		FIO												

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		10180	GA- SD-08 Manufacturer's Instructions Care and Maintenance Instructions		FIO												
		10201	SD-02 Shop Drawings Wall louvers	2.2	FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			GA-SAB		FIO												
			SD-04 Samples Wall louvers	2.2	FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			GA-SAB		FIO												
		10260	SD-02 Shop Drawings Corner Guards	2.2.1	FIO												
			GA-BK		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Wall Guards (Crash Rails)		FIO												
			SD-03 Product Data Corner Guards	2.2.1	FIO												

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		10260	Wall Guards (Crash Rails)		FIO												
			SD-04 Samples														
			Finishes	2.7	FIO												
			GA-BK		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-07 Certificates														
			Corner Guards	2.2.1	FIO												
			GA-BK		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Wall Guards (Crash Rails)		FIO												
		10441	SD-02 Shop Drawings														
			Interior Signage		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			GA-SAB		FIO												
			SD-03 Product Data														
			Interior Signage		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			GA-SAB		FIO												

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		10441	SD-04 Samples														
			Interior Signage		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			GA-SAB		FIO												
		10500	SD-02 Shop Drawings														
			Drawings		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			GA-BK		FIO												
			SD-03 Product Data														
			Manufacturer's Data		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			GA-BK		FIO												
			SD-04 Samples														
			Manufacturer's Finishes		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			GA-BK		FIO												
		10520	SD-03 Product Data														
			Fire Extinguisher Cabinet		FIO												
			GA-BK		FIO												
			GA-DN		FIO												

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		10520	GA-HQ		FIO												
			SD-08 Manufacturer's Instructions														
			Fire Extinguisher Cabinet		FIO												
			GA-BK		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
		10605	SD-02 Shop Drawings														
			Wire mesh partitions	1.4	FIO												
			SD-03 Product Data														
			Wire mesh partitions	1.4	FIO												
		10800	SD-01 Preconstruction Submittals														
			Finishes	2.1.2	FIO												
			FYI-AO		FIO												
			Accessory Items	2.2	FIO												
			Finishes	2.1.2	FIO												
			GA-AO		FIO												
			Accessory Items	2.2	FIO												
		10900	SD-02 Shop Drawings														
			Wardrobe Units		FIO												
			GA-BK		FIO												
			SD-03 Product Data														
			Wardrobe Units		FIO												
			GA-BK		FIO												
			SD-04 Samples														
			Wardrobe Units		FIO												
			GA-BK		FIO												

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		10900	Metal Finishes	2.3.11	FIO												
			Bunkbed Units; GA-BK		FIO												
			SD-06 Test Reports														
			Static Load Tests		FIO												
			GA-AO		FIO												
		11131	SD-03 Product Data														
			Electrically Operated Front		FIO												
			Projection Screens														
			GA-BK		FIO												
			GA-HQ		FIO												
			SD-08 Manufacturer's Instructions														
			Projection Screens		FIO												
		11162	SD-02 Shop Drawings														
			Loading Dock Levelers	2.1	FIO												
			GA-DN		FIO												
			SD-03 Product Data														
			Loading Dock Levelers	2.1	FIO												
			GA-DN		FIO												
			SD-10 Operation and Maintenance														
			Data														
			Loading Dock Levelers	2.1	FIO												
		11400	SD-02 Shop Drawings														
			Food Service Equipment		FIO												
			GA-DN		FIO												
			SD-03 Product Data														
			Food Service Equipment		FIO												



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		11400	GA-DN		FIO												
			SD-06 Test Reports														
			Testing	3.3	FIO												
			GA-DN		FIO												
			SD-10 Operation and Maintenance														
			Data														
			Food Service Equipment		FIO												
		11402	SD-03 Product Data														
			Top Load Washers and		FIO												
			Single-Load Stack Dryers														
			GA-BK		FIO												
			SD-08 Manufacturer's Instructions														
			Top Load Washers		FIO												
			GA-AO		FIO												
			Single-Load Stack Dryers		FIO												
			SD-10 Operation and Maintenance														
			Data														
			Top Load Washers & Single-Load		FIO												
			Stack Dryers														
			GA-AO		FIO												
		12000	SD-03 Product Data														
			GA-DN		FIO												
			GA-HQ		FIO												
			GA-CH		FIO												
			GA-BK		FIO												
			SD-04 Samples														

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		12000	GA-DN		FIO												
			GA-HQ		FIO												
			GA-CH		FIO												
			GA-BK		FIO												
		12490	SD-02 Shop Drawings														
			Window Treatments and		FIO												
			Hardware														
			GA-DN		FIO												
			GA-HQ		FIO												
			GA-BK		FIO												
			SD-03 Product Data														
			Window Treatments and		FIO												
			Hardware														
			GA-DN		FIO												
			GA-HQ		FIO												
			GA-BK		FIO												
			SD-04 Samples														
			Window Treatments and		FIO												
			Hardware														
			GA-		FIO												
		12602	SD-02 Shop Drawings														
			seating unit		FIO												
			GA-BK		FIO												
			Seating and Table system		FIO												
			SD-06 Test Reports														
			Cigarette ignition	2.1.1	FIO												

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		12602	GA-AO		FIO												
			SD-08 Manufacturer's Instructions														
			Installation	3.1	FIO												
			GA-AO		FIO												
		12690	SD-02 Shop Drawings														
			Entrance Mats		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			GA-BK		FIO												
			SD-03 Product Data														
			Finishes		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			GA-BK		FIO												
			Accessory Items		FIO												
			SD-04 Samples														
			Finishes		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			GA-BK		FIO												
		12705	SD-02 Shop Drawings														
			Workstations		FIO												
			GA-BK		FIO												
			SD-03 Product Data														
			Manufacturer's Product Data		FIO												
			GA-BK		FIO												

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		12705	SD-04 Samples														
			Workstations		G												
			SD-06 Test Reports														
			Selected Components	2.1.1	G												
			Panel Acoustics	2.1.2	G												
			Fire Safety	2.1.3	G												
			Electrical System	2.1.5	G												
			SD-07 Certificates														
			Certificate of Compliance		FIO												
			Warranty	1.8	G												
			SD-10 Operation and Maintenance														
			Data														
			Product Assembly Manual		FIO												
			Product Maintenance Manuals		FIO												
			Electrical Systems Manual		FIO												
		13120	SD-02 Shop Drawings														
			Drawings		FIO												
			GA-CH		FIO												
			SD-03 Product Data														
			Design Analysis	1.5	FIO												
			GA-CH		FIO												
			Instruction Manuals		FIO												
			Erection	3.1	FIO												
			Qualifications	1.3.2	FIO												
			SD-04 Samples														
			Accessories	2.3.7	FIO												

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		13120	Roofing and Siding	2.3	FIO												
			Fasteners	2.5	FIO												
			Insulation	2.14	FIO												
			Gaskets and Insulating Compounds	2.16	FIO												
			Sealant	2.15	FIO												
			Wall Liners	2.4	FIO												
			SD-07 Certificates														
			Metal Building Systems		FIO												
			GA-CH		FIO												
			Insulation	2.14	FIO												
		13850	SD-02 Shop Drawings														
			Fire Alarm Reporting System	1.4.1	FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-03 Product Data														
			Storage Batteries	2.2	FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Voltage Drop		FIO												
			Spare Parts	2.8.4	FIO												
			Technical Data and Computer Software	1.5	FIO												
			GA-AO		FIO												

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		13850	Training	3.6	FIO												
			Testing	3.5	FIO												
			SD-06 Test Reports														
			Testing	3.5	FIO												
			SD-07 Certificates														
			Equipment		FIO												
			Qualifications	1.3.7	FIO												
			GA-AO		FIO												
			SD-10 Operation and Maintenance														
			Data														
			Technical Data and Computer	1.5	FIO												
			Software														
		13851	SD-02 Shop Drawings														
			Fire Alarm Reporting System		FIO												
			GA-KC		FIO												
			SD-03 Product Data														
			Storage Batteries	2.2	FIO												
			GA-KC		FIO												
			Voltage Drop		FIO												
			Spare Parts		FIO												
			GA-AO		FIO												
			Technical Data and Computer	1.4	FIO												
			Software														
			GA		FIO												
			SD-06 Test Reports														
			Testing	3.5	FIO												

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		13851	GA-AO		FIO												
			SD-07 Certificates														
			Equipment		FIO												
			GA-KC		FIO												
			Qualifications	1.2.7	FIO												
			GA-AO		FIO												
			SD-08 Manufacturer's Instructions														
			Training	3.6	FIO												
			GA-AO		FIO												
			Testing	3.5	FIO												
			GA-KC		FIO												
			SD-10 Operation and Maintenance														
			Data														
			Technical Data and Computer	1.4	FIO												
			Software														
			GA		FIO												
		13930	SD-02 Shop Drawings														
			Sprinkler System Shop Drawings		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			As-Built Drawings		FIO												
			SD-03 Product Data														
			Load Calculations for Sizing Sway		FIO												
			Bracing														

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		13930	GA-AO		FIO												
			Components and Equipment Data		FIO												
			Sprinkler System Equipment														
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Hydraulic Calculations	1.7	FIO												
			Spare Parts		FIO												
			SD-06 Test Reports														
			Preliminary Tests		FIO												
			GA-AO		FIO												
			Test Procedures		FIO												
			GA-A		FIO												
			Final Acceptance Test		FIO												
			SD-07 Certificates														
			Fire Protection Specialist		FIO												
			Inspection Contractor's Material														
			and Test Certificates														
			SD-08 Manufacturer's Instructions														
			Fire Protection Specialist Installer		FIO												
			Specialist Installer Qualifications														
			GA-AO		FIO												
			Sprinkler System Installer		FIO												
			Submittal Installer Submittal														
			Preparer's Qualifications														



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		13930	GA		FIO												
			SD-10 Operation and Maintenance Data														
			Wet Pipe Sprinkler System		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
		13965	SD-02 Shop Drawings														
			Wet Chemical Fire Extinguishing System		FIO												
			GA-DN		FIO												
			SD-03 Product Data														
			Similar Services		FIO												
			Wet Chemical Fire Extinguishing System		FIO												
			GA-DN		FIO												
			Preliminary Tests	3.2	FIO												
			GA-AO		FIO												
			Final Acceptance Tests	3.3	FIO												
			System Diagrams		FIO												
			Test Schedule		FIO												
			Field Training	3.4	FIO												
			SD-06 Test Reports														
			Preliminary Tests	3.2	FIO												
			GA-AO		FIO												

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		13965	Final Acceptance Tests	3.3	FIO												
			SD-07 Certificates														
			Installation Technician	1.3.4	FIO												
			GA-AO		FIO												
			Installation Drawings	1.3.3	FIO												
			GA-DN		FIO												
			SD-10 Operation and Maintenance														
			Data														
			Wet Chemical Fire Extinguishing		FIO												
			System														
			GA-DN		FIO												
		14630	SD-02 Shop Drawings														
			Overhead Crane System		FIO												
			GA-AO		FIO												
			SD-03 Product Data														
			Overhead Crane System		FIO												
			Spare Parts		FIO												
			GA-AO		FIO												
			SD-06 Test Reports														
			Acceptance Testing	3.2	FIO												
			GA-AO		FIO												
			SD-08 Manufacturer's Instructions														
			Framed Instructions		FIO												
			SD-10 Operation and Maintenance														
			Data														
			Overhead Crane System		FIO												

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		14630	GA-AO		FIO												
		15070	SD-02 Shop Drawings														
			Coupling and Bracing	3.1	FIO												
			GA-BK, GA-CH, GA-DN, GA-HQ		FIO												
			Flexible Couplings or Joints	3.3	FIO												
			Equipment Requirements	1.3	FIO												
			Contractor Designed Bracing	1.2.4	FIO												
			SD-03 Product Data														
			Coupling and Bracing	3.1	FIO												
			GA-BK, GA-CH, GA-DN, GA-HQ		FIO												
			Equipment Requirements	1.3	FIO												
			Contractor Designed Bracing	1.2.4	FIO												
			SD-07 Certificates														
			Flexible Ball Joints	2.2	FIO												
			GA-BK, GA-CH, GA-DN, GA-HQ		FIO												
		15080	SD-04 Samples														
			Thermal Insulation Materials		FIO												
			GA		FIO												
		15190	SD-02 Shop Drawings														
			Gas Piping System		FIO												
			GA-BK		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-03 Product Data														
			Qualifications		FIO												
			SD-06 Test Reports														

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		15190	Testing		FIO												
			GA-AO		FIO												
			Pressure Tests		FIO												
			Test With Gas		FIO												
		15400	SD-02 Shop Drawings														
			Plumbing System		FIO												
			Electrical Schematics		FIO												
			SD-03 Product Data														
			Welding		FIO												
			Plumbing Fixture Schedule		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-BK		FIO												
			GA-HQ		FIO												
			Vibration-Absorbing Features	3.4	FIO												
			SD-06 Test Reports														
			Tests, Flushing and Disinfection	3.9	FIO												
			Backflow Prevention Assembly		FIO												
			Tests														
			SD-07 Certificates														
			Materials and Equipment		FIO												
			GA-AO		FIO												
			Bolts		FIO												
			SD-08 Manufacturer's Instructions														
			Plumbing System		FIO												

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		15400	SD-10 Operation and Maintenance														
			Data														
			Plumbing System		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
		15565	SD-02 Shop Drawings														
			Heating System		FIO												
			GA-CH		FIO												
			SD-03 Product Data														
			Heating System		FIO												
			GA-CH		FIO												
			SD-06 Test Reports														
			Testing, Adjusting, and Balancing	3.2	FIO												
			SD-08 Manufacturer's Instructions														
			Heating System		FIO												
		15569	SD-02 Shop Drawings														
			Heating System		FIO												
			GA-AO		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Piping Installation	3.2	FIO												
			Installation	3.2.6.4	FIO												

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		15569	Installation	3.2.12	FIO												
			SD-03 Product Data														
			Manufacturer's Catalog Data		FIO												
			GA-DN		FIO												
			GA-BK		FIO												
			GA-HQ		FIO												
			Spare Parts Data		FIO												
			Water Treatment Plan		FIO												
			GA-AO		FIO												
			Qualification		FIO												
			SD-06 Test Reports														
			Tests	3.3	FIO												
			Heating System and Fuel System		FIO												
			Tests														
			Water Treatment Tests		FIO												
			SD-07 Certificates														
			Bolts	2.10.12.3	FIO												
			Boiler Emissions		FIO												
			SD-10 Operation and Maintenance														
			Data														
			Heating System		FIO												
			GA-BK		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Water Treatment System		FIO												
		15650	SD-02 Shop Drawings														

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		15650	Central Refrigerated Air-Conditioning System GA-CH.		FIO												
			SD-03 Product Data														
			Central Refrigerated Air-Conditioning System GA-CH		FIO												
			Water Treatment Systems	2.10	FIO												
			Spare Parts		FIO												
			Qualifications	1.4	FIO												
			SD-06 Test Reports														
			Factory Tests	2.13	FIO												
			Field Tests	3.2.1	FIO												
			System Performance Tests	3.2.2	FIO												
			Condenser Water Quality Tests	3.2.3	FIO												
			Inspections	3.3	FIO												
			SD-07 Certificates														
			Central Refrigerated Air-Conditioning System		FIO												
			Water Treatment System		FIO												
			SD-08 Manufacturer's Instructions														
			Posted Instructions		FIO												
			Factory Tests	2.13	FIO												
			Tests	3.2	FIO												
			Demonstrations	3.6	FIO												
			Verification of Dimensions	1.7.1	FIO												

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		15650	GA-AO		FIO												
			Manufacturer's Multi-Year		FIO												
			Compressor Warranty														
		15653	SD-02 Shop Drawings														
			Air-Conditioning/Heat Pump		FIO												
			System														
			GA-AO		FIO												
			SD-03 Product Data														
			Air-Conditioning/Heat Pump		FIO												
			System														
			GA-DN		FIO												
			GA-HQ		FIO												
			Spare Parts Data		FIO												
			SD-06 Test Reports														
			Tests	3.2	FIO												
			GA-AO		FIO												
			System Performance Tests	3.2.6	FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Inspections		FIO												
			SD-07 Certificates														
			Air-Conditioning/Heat Pump		FIO												
			System														
			Service Organizations		FIO												
			SD-08 Manufacturer's Instructions														
			Framed Instructions	3.1.19	FIO												



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		15653	Tests	3.2	FIO												
			Demonstrations	3.5	FIO												
			GA-AO		FIO												
			Qualifications	1.3	FIO												
			Verification of Dimensions	1.5.1	FIO												
			SD-10 Operation and Maintenance														
			Data														
			Operation Manual		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Maintenance Manual		FIO												
			GA-AO		FIO												
		15895	SD-02 Shop Drawings														
			Air Supply, Distribution,		FIO												
			Ventilation, and Exhaust Equipment														
			GA-BK		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-03 Product Data														
			Components and Equipment Data		FIO												
			GA-DN		FIO												
			GA-BK		FIO												
			GA-HQ		FIO												
			SD-06 Test Reports														
			Test Reports		FIO												
			GA-AO		FIO												

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		15895	Test Schedules		FIO												
			Field Training Schedule		FIO												
			SD-07 Certificates														
			Bolts		FIO												
			GA-AO		FIO												
			SD-08 Manufacturer's Instructions														
			Test Procedures		FIO												
			GA-AO		FIO												
			Welding Procedures		FIO												
			System Diagrams		FIO												
			Similar Services		FIO												
			Welding Qualification		FIO												
			SD-10 Operation and Maintenance														
			Data														
			Air Supply, Distribution,		FIO												
			Ventilation, and Exhaust Manuals														
			GA-BK		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
		15951	SD-02 Shop Drawings														
			HVAC Control System		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-03 Product Data														

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		15951	Equipment Compliance Booklet		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-06 Test Reports														
			Commissioning Report		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Performance Verification Test		FIO												
			Report														
			SD-07 Certificates														
			ASME Air-Storage Tank		FIO												
			Certificate														
			SD-08 Manufacturer's Instructions														
			Commissioning Procedures		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Performance Verification Test		FIO												
			Procedures														
			Training Course Materials		FIO												

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		15951	SD-10 Operation and Maintenance														
			Data														
			Operation Manual		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Maintenance and Repair Manual		FIO												
			Service Organizations		FIO												
		15990	SD-02 Shop Drawings														
			TAB Schematic Drawings and		FIO												
			Report Forms														
			GA-AO		FIO												
			SD-03 Product Data														
			TAB Related HVAC Submittals		FIO												
			GA-AO		FIO												
			SD-06 Test Reports														
			Design Review Report	3.1	FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Systems Readiness Check Report		FIO												
			GA-AO		FIO												
			TAB Report	3.5.3	FIO												
			TAB Verification Report	3.5.4	FIO												

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		15990	SD-07 Certificates														
			TAB Firm	1.4	FIO												
			GA-AO		FIO												
			TAB Specialist	1.4	FIO												
			Instrument Calibration		FIO												
			Ductwork Leak Testing	3.4	FIO												
			SD-08 Manufacturer's Instructions														
			TAB Procedures	3.5.1	FIO												
			GA-AO		FIO												
			Systems Readiness Check		FIO												
			TAB Execution	3.5.1	FIO												
			TAB Verification	3.5.4	FIO												
		15995	SD-03 Product Data														
			Commissioning Team		FIO												
			SD-06 Test Reports														
			Test Reports		FIO												
			GA-AO		FIO												
			SD-08 Manufacturer's Instructions														
			Test Procedures		FIO												
			Test Schedule		FIO												
			GA-AO		FIO												
		16070	SD-02 Shop Drawings														
			Lighting Fixtures in Buildings	3.2	FIO												
			Equipment Requirements	1.4	FIO												
			SD-03 Product Data														
			Lighting Fixtures in Buildings	3.2	FIO												

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		16070	GA-DN		FIO												
			Equipment Requirements	1.4	FIO												
			Contractor Designed Bracing	1.3.4	FIO												
		16311	SD-02 Shop Drawings														
			General Installation Requirements	3.1	FIO												
			GA-SAB		FIO												
			Detail Drawings		FIO												
			As-Built Drawings		FIO												
			SD-03 Product Data														
			Support Structures	2.4.1	FIO												
			GA-SAB		FIO												
			Fault Current Analysis		FIO												
			Protective Devices		FIO												
			Coordination Study		FIO												
			Material and Equipment		FIO												
			General Installation Requirements	3.1	FIO												
			Onsite Tests	3.6.2	FIO												
			SD-06 Test Reports														
			Factory Tests	2.15	FIO												
			Field Testing	3.5	FIO												
			Field Test Reports	3.5.1	FIO												
			SD-07 Certificates														
			Material and Equipment		FIO												
			SD-10 Operation and Maintenance														
			Data														

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		16311	Operation and Maintenance Manuals	3.6.1	FIO												
		16375	SD-02 Shop Drawings														
			Electrical Distribution System	3.11.3	FIO												
			GA-SKC		FIO												
			As-Built Drawings		FIO												
			SD-03 Product Data														
			Fault Current Analysis	2.19.4	FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			GA-SAB		FIO												
			Protective Device	2.19	FIO												
			Coordination Study	2.19.5	FIO												
			Nameplates	2.2	FIO												
			GA-SKC		FIO												
			Material and Equipment	2.1	FIO												
			General Installation Requirements	3.1	FIO												
			SD-06 Test Reports														
			Factory Tests	2.17	FIO												
			GA-AO		FIO												
			Field Testing	3.11	FIO												
			Operating Tests	3.11.13	FIO												
					FIO												
			Cable Installation	3.2.1.4	FIO												
			SD-07 Certificates														

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		16375	Material and Equipment	2.1	FIO												
			GA-SAB		FIO												
			Cable Joints	3.3	FIO												
			Cable Installer Qualifications		FIO												
			SD-10 Operation and Maintenance Data														
			Electrical Distribution System	3.11.3	FIO												
		16403	SD-02 Shop Drawings														
			Drawings	2.4.2	G [ ]												
			Shop Drawings	2.2.1	G [ ]												
			Motor Control Centers	2.6	G [ ]												
			Switchboards	2.7	G [ ]												
			Panelboards	2.8	G [ ]												
			SD-03 Product Data														
			Equipment	1.4	G [ ]												
			Factory Tests	2.10	FIO												
			[ ], [ ]		FIO												
			SD-06 Test Reports														
			Factory Tests	2.10	FIO												
			[ ], [ ]		FIO												
			SD-07 Certificates														
			Motor Control Centers	2.6	FIO												
			[ ], [ ]		FIO												
		16415	SD-02 Shop Drawings														
			Interior Electrical Equipment		FIO												
			GA-BK		FIO												



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		16415	GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-03 Product Data														
			Fault Current and Protective Device Coordination Study		FIO												
			GA-SKC		FIO												
			Manufacturer's Catalog		FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Material, Equipment, and Fixture Lists		FIO												
			Installation Procedures		FIO												
			As-Built Drawings	1.2.6	FIO												
			GA-AO		FIO												
			Onsite Tests	3.24.2	FIO												
			SD-06 Test Reports														
			Factory Test Reports		FIO												
			GA-AO		FIO												
			Field Test Plan		FIO												
			Field Test Reports	3.22	FIO												
			SD-07 Certificates														
			Materials and Equipment	1.4	FIO												
		16475	SD-03 Product Data														

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		16475	Fault Current Analysis	2.14	FIO												
			GA-SAB		FIO												
			Protective Device Coordination	2.14	FIO												
			Study														
			Equipment		FIO												
			System Coordinator	1.4.1	FIO												
			Protective Relays	3.3.5	FIO												
			Installation	3.2	FIO												
			SD-06 Test Reports														
			Field Testing	3.3	FIO												
			SD-07 Certificates														
			Devices and Equipment	1.6	FIO												
		16710	SD-02 Shop Drawings														
			Premises Distribution System	1.7	FIO												
			GA-BK		FIO												
			GA-CH		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			Record Drawings		FIO												
			GA-AO		FIO												
			SD-03 Product Data														
			Record Keeping and		FIO												
			Documentation														
			GA-AO		FIO												
			Spare Parts		FIO												
			Manufacturer's Recommendations	3.1.2	FIO												

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		16710	Test Plan		FIO												
			Qualifications	1.4	FIO												
			SD-06 Test Reports														
			Test Reports		FIO												
			SD-07 Certificates														
			Premises Distribution System	1.7	FIO												
			Materials and Equipment	2.1	FIO												
			Installers		FIO												
			GA-AO		FIO												
		16770	SD-03 Product Data														
			Spare Parts		FIO												
			SD-02 Shop Drawings														
			Radio and Public Address System		FIO												
			GA-BK		FIO												
			GA-DN		FIO												
			GA-HQ		FIO												
			SD-06 Test Reports														
			Test Plan		FIO												
			GA-AO		FIO												
			Acceptance Tests	3.3	FIO												
			SD-10 Operation and Maintenance														
			Data														
			Radio and Public Address System		FIO												

## SECTION 01410

## ENVIRONMENT PROTECTION

02/97

## 1.1 GENERAL REQUIREMENTS

The Contractor shall perform the work minimizing environmental pollution and damage as the result of construction operations. Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the utility of the environment for aesthetic, cultural and/or historical purposes. The control of environmental pollution and damage requires consideration of land, water, and air, and includes management of visual aesthetics, noise, and solid waste, as well as other pollutants. The environmental resources within the project boundaries and those affected outside the limits of permanent work shall be protected during the entire duration of this contract.

## 1.1.1 Subcontractors

The Contractor shall ensure compliance with this section by subcontractors.

## 1.1.2 Environmental Protection Plan

The Contractor shall submit an environmental protection plan within 20 days after receipt of the notice to proceed. Approval of the Contractor's plan will not relieve the Contractor of responsibility for adequate and continuing control of pollutants and other environmental protection measures. The environmental protection plan shall include, but shall not be limited to, the following:

- a. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.
- b. Methods for protection of features to be preserved within authorized work areas like trees, shrubs, vines, grasses and ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, archaeological, and cultural resources.
- c. Procedures to be implemented to provide the required environmental protection, to comply with the applicable laws and regulations, and to correct pollution due to accident, natural causes, or failure to follow the procedures of the environmental protection plan.
- d. Permit or license and location of the solid waste disposal area.
- e. Drawings showing locations of any proposed temporary excavations or

embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials.

- f. Environmental monitoring plans for the job site, including land, water, air, and noise monitoring.
- g. Traffic control plan including measures to reduce erosion of temporary roadbeds by construction traffic, especially during wet weather, and the amount of mud transported onto paved public roads by vehicles or runoff.
- h. Methods of protecting surface and ground water during construction activities.
- i. Plan showing the proposed activity in each portion of the work area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas.
- j. Drawing of borrow area location. Protection measures required at the work site shall apply to the borrow areas including final restoration for subsequent beneficial use of the land.
- k. A recycling and waste prevention plan with a list of measures to reduce consumption of energy and natural resources; for example: the possibility to shred fallen trees and use them as mulch shall be considered as an alternative to burning or burial.
- l. A settling pond removal plan 120 days prior to removal work. The plan shall include the method of removing and testing of the collected sediment.
- m. Training for Contractor's personnel during the construction period.

#### 1.1.3 Permits

The Contractor shall obtain all needed permits or licenses. The Government will not obtain any permits for this project; see Contract Clause PERMITS AND RESPONSIBILITIES.

#### 1.1.4 Preconstruction Survey

Prior to starting any onsite construction activities, the Contractor and the Contracting Officer shall make a joint condition survey after which the Contractor shall prepare a brief report indicating on a layout plan the condition of trees, shrubs and grassed areas immediately adjacent to work sites and adjacent to the assigned storage area and access routes as applicable. This report will be signed by both the Contracting Officer and the Contractor upon mutual agreement as to its accuracy and completeness.

#### 1.1.5 Meetings

The Contractor shall meet with representatives of the Contracting Officer to alter the environmental protection plan as needed for compliance with the

environmental pollution control program.

#### 1.1.6 Notification

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with the previously mentioned Federal, State or local laws or regulations, permits, and other elements of the Contractor's environmental protection plan. The Contractor shall, after receipt of such notice, inform the Contracting Officer of proposed corrective action and take such action when approved. If the Contractor fails to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No time extensions shall be granted or costs or damages allowed to the Contractor for any such suspensions.

#### 1.1.7 Litigation

If work is suspended, delayed, or interrupted due to a court order of competent jurisdiction, the Contracting Officer will determine whether the order is due in any part to the acts or omissions of the Contractor, or subcontractors at any tier, not required by the terms of the contract. If it is determined that the order is not due to Contractor's failing, such suspension, delay, or interruption shall be considered as ordered by the Contracting Officer in the administration of the contract under the contract clause SUSPENSION OF WORK.

#### 1.1.8 Previously Used Equipment

The Contractor shall thoroughly clean all construction equipment previously used at other sites before it is brought into the work areas, ensuring that soil residuals are removed and that egg deposits from plant pests are not present; the Contractor shall consult with the USDA jurisdictional office for additional cleaning requirements.

#### 1.1.9 Payment

No separate payment will be made for work covered under this section; all costs associated with this section shall be included in the contract unit and/or lump sum prices in the Bidding Schedule.

### 1.2 LAND RESOURCES

The Contractor shall confine all activities to areas defined by the drawings and specifications. Prior to the beginning of any construction, the Contractor shall identify the land resources to be preserved within the work area. Except in areas indicated on the drawings or specified to be cleared, the Contractor shall not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and land forms without permission. No ropes, cables, or guys shall be fastened to or attached to any trees for anchorage unless specifically authorized. Where such emergency use is permitted, the Contractor shall provide effective protection for land and vegetation resources at all times as defined in the following subparagraphs. Stone, earth or other material displaced into uncleared areas shall be removed.

### 1.2.1 Work Area Limits

Prior to any construction, the Contractor shall mark the areas that need not be disturbed under this contract. Isolated areas within the general work area which are to be saved and protected shall also be marked or fenced. Monuments and markers shall be protected before construction operations commence. Where construction operations are to be conducted during darkness, the markers shall be visible. The Contractor's personnel shall be knowledgeable of the purpose for marking and/or protecting particular objects.

### 1.2.2 Landscape

Trees, shrubs, vines, grasses, land forms and other landscape features indicated and defined on the drawings to be preserved shall be clearly identified by marking, fencing, or wrapping with boards, or any other approved techniques.

### 1.2.3 Unprotected Erodible Soils

Earthwork brought to final grade shall be finished as indicated. Side slopes and back slopes shall be protected as soon as practicable upon completion of rough grading. All earthwork shall be planned and conducted to minimize the duration of exposure of unprotected soils. Except in cases where the constructed feature obscures borrow areas, quarries, and waste material areas, these areas shall not initially be totally cleared. Clearing of such areas shall progress in reasonably sized increments as needed to use the developed areas as approved by the Contracting Officer.

### 1.2.4 Disturbed Areas

The Contractor shall effectively prevent erosion and control sedimentation through approved methods including, but not limited to, the following:

- a. Retardation and control of runoff. Runoff from the construction site or from storms shall be controlled, retarded, and diverted to protected drainage courses by means of diversion ditches, benches, berms, and by any measures required by area wide plans under the Clean Water Act.
- b. Erosion and sedimentation control devices. The Contractor shall construct or install temporary and permanent erosion and sedimentation control features as indicated on the drawings. Berms, dikes, drains, sedimentation basins, grassing, and mulching shall be maintained until permanent drainage and erosion control facilities are completed and operative.
- c. Sediment basins. Sediment from construction areas shall be trapped in temporary or permanent sediment basins in accordance with the drawings. The basins shall accommodate the runoff of a local 5 year storm. After each storm, the basins shall be pumped dry and accumulated sediment shall be removed to maintain basin effectiveness. Overflow shall be controlled by paved weirs or by

vertical overflow pipes. The collected topsoil sediment shall be reused for fill on the construction site, and/or stockpiled for use at another site. The Contractor shall institute effluent quality monitoring programs as required by State and local environmental agencies.

#### 1.2.5 Contractor Facilities and Work Areas

The Contractor's field offices, staging areas, stockpile storage, and temporary buildings shall be placed in areas designated by the Contracting Officer. Temporary movement or relocation of Contractor facilities shall be made only when approved. Borrow areas shall be managed to minimize erosion and to prevent sediment from entering nearby waters. Spoil areas shall be managed and controlled to limit spoil intrusion into areas designated on the drawings and to prevent erosion of soil or sediment from entering nearby waters. Spoil areas shall be developed in accordance with the grading plan indicated on the drawings. Temporary excavation and embankments for plant and/or work areas shall be controlled to protect adjacent areas from despoilment.

### 1.3 WATER RESOURCES

The Contractor shall keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters. Toxic or hazardous chemicals shall not be applied to soil or vegetation when such application may cause contamination of the fresh water reserve. Monitoring of water areas affected by construction shall be the Contractor's responsibility. All water areas affected by construction activities shall be monitored by the Contractor.

#### 1.3.1 Washing and Curing Water

Waste waters directly derived from construction activities shall not be allowed to enter water areas. Waste waters shall be collected and placed in retention ponds where suspended material can be settled out or the water evaporates to separate pollutants from the water. Analysis shall be performed and results reviewed and approved before water in retention ponds is discharged.

#### 1.3.2 Cofferdam and Diversion Operations

Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure shall be controlled at all times to limit the impact of water turbidity on the habitat for wildlife and on water quality for downstream use.

#### 1.3.3 Stream Crossings

Stream crossings shall allow movement of materials or equipment without violating water pollution control standards of the Federal, State or local government.

#### 1.3.4 Fish and Wildlife



The Contractor shall minimize interference with, disturbance to, and damage of fish and wildlife. Species that require specific attention along with measures for their protection shall be listed by the Contractor prior to beginning of construction operations.

#### 1.4 AIR RESOURCES

Equipment operation and activities or processes performed by the Contractor in accomplishing the specified construction shall be in accordance with Kansas Department of Health and Environment (KDHE) rules and all Federal emission and performance laws and standards. Ambient Air Quality Standards set by the Environmental Protection Agency shall be maintained. Monitoring of air quality shall be the Contractor's responsibility. All air areas affected by the construction activities shall be monitored by the Contractor. Monitoring results will be periodically reviewed by the Government to ensure compliance.

##### 1.4.1 Particulates

Dust particles; aerosols and gaseous by-products from construction activities; and processing and preparation of materials, such as from asphaltic batch plants; shall be controlled at all times, including weekends, holidays and hours when work is not in progress. The Contractor shall maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates which would cause the air pollution standards to be exceeded or which would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp at all times. The Contractor must have sufficient, competent equipment available to accomplish these tasks. Particulate control shall be performed as the work proceeds and whenever a particulate nuisance or hazard occurs.

##### 1.4.2 Hydrocarbons and Carbon Monoxide

Hydrocarbons and carbon monoxide emissions from equipment shall be controlled to Federal and State allowable limits at all times.

##### 1.4.3 Odors

Odors shall be controlled at all times for all construction activities, processing and preparation of materials.

##### 1.4.4 Sound Intrusions

The Contractor shall use methods and devices to control noise emitted by equipment.

#### 1.5 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Existing historical, archaeological, and cultural resources within the Contractor's work area will be so designated by the Contracting Officer if

any has been identified. The Contractor shall take precautions to preserve all such resources as they existed at the time they were first pointed out. The Contractor shall provide and install protection for these resources and be responsible for their preservation during the life of the contract. If during excavation or other construction activities any previously unidentified or unanticipated resources are discovered or found, all activities that may damage or alter such resources shall be temporarily suspended. Resources covered by this paragraph include but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rocks or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, the Contractor shall immediately notify the Contracting Officer. While waiting for instructions the Contractor shall record, report, and preserve the finds.

#### 1.6 POST CONSTRUCTION CLEANUP

The Contractor shall clean up all areas used for construction.

#### 1.7 RESTORATION OF LANDSCAPE DAMAGE

The Contractor shall restore landscape features damaged or destroyed during construction operations outside the limits of the approved work areas.

#### 1.8 MAINTENANCE OF POLLUTION FACILITIES

The Contractor shall maintain permanent and temporary pollution control facilities and devices for the duration of the contract or for that length of time construction activities create the particular pollutant.

#### 1.9 TRAINING OF CONTRACTOR PERSONNEL

The Contractor's personnel shall be trained in all phases of environmental protection. The training shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, and installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental pollution control.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

-- End of Section --

## SECTION 01451

## CONTRACTOR QUALITY CONTROL

**04/97**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3740 (1999b) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

ASTM E 329 (1998a) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

## 1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program, and all costs associated therewith shall be included in the applicable unit prices or lump-sum prices contained in the Bidding Schedule.

## PART 2 PRODUCTS (Not Applicable)

## PART 3 EXECUTION

## 3.1 GENERAL REQUIREMENTS

The Contractor is responsible for quality control and shall establish and maintain an effective quality control system in compliance with the Contract Clause titled "Inspection of Construction." The quality control system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the contract requirements. The system shall cover all construction operations, both onsite and offsite, and shall be keyed to the proposed construction sequence. The site project superintendent will be held responsible for the quality of work on the job and is subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the contract. The site project superintendent in this context shall be the highest level manager responsible for the overall construction activities at the site, including quality and production. The site project superintendent shall maintain a physical presence at the site at all times, except as otherwise acceptable to the Contracting Officer, and shall be responsible for all construction

and construction related activities at the site.

### 3.2 QUALITY CONTROL PLAN

The Contractor shall furnish for review by the Government, not later than 20 days after receipt of notice to proceed, the Contractor Quality Control (CQC) Plan proposed to implement the requirements of the Contract Clause titled "Inspection of Construction." The plan shall identify personnel, procedures, control, instructions, tests, records, and forms to be used. The Government will consider an interim plan for the first 30 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the features of work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of work to be started.

#### 3.2.1 Content of the CQC Plan

The CQC Plan shall include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, fabricators, suppliers, and purchasing agents:

- a. A description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff shall implement the three phase control system for all aspects of the work specified. The staff shall include a CQC System Manager who shall report to the project superintendent.
- b. The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a CQC function.
- c. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters shall also be furnished to the Government.
- d. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. These procedures shall be in accordance with Section 01330 SUBMITTAL PROCEDURES.
- e. Control, verification, and acceptance testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities will be approved by the Contracting Officer.)

- f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests including documentation.
- g. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures shall establish verification that identified deficiencies have been corrected.
- h. Reporting procedures, including proposed reporting formats.
- i. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks, has separate control requirements, and may be identified by different trades or disciplines, or it may be work by the same trade in a different environment. Although each section of the specifications may generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. This list will be agreed upon during the coordination meeting.

#### 3.2.2 Acceptance of Plan

Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The Government reserves the right to require the Contractor to make changes in his CQC Plan and operations including removal of personnel, as necessary, to obtain the quality specified.

#### 3.2.3 Notification of Changes

After acceptance of the CQC Plan, the Contractor shall notify the Contracting Officer in writing of any proposed change. Proposed changes are subject to acceptance by the Contracting Officer.

#### 3.3 COORDINATION MEETING

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, the Contractor shall meet with the Contracting Officer or Authorized Representative and discuss the Contractor's quality control system. During the meeting, a mutual understanding of the system details shall be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting shall be prepared by the Government and signed by both the Contractor and the Contracting Officer. The minutes shall become a part of the contract file. There may be occasions when subsequent conferences will be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures which may require corrective action by the Contractor.

#### 3.4 QUALITY CONTROL ORGANIZATION

#### 3.4.1 Personnel Requirements

The requirements for the CQC organization are a CQC System Manager and sufficient number of additional qualified personnel to ensure safety and contract compliance. The Safety and Health Manager shall receive direction and authority from the CQC System Manager and shall serve as a member of the CQC staff. Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly will also be included as part of the CQC organization. The Contractor's CQC staff shall maintain a presence at the site at all times during progress of the work and have complete authority and responsibility to take any action necessary to ensure contract compliance. The CQC staff shall be subject to acceptance by the Contracting Officer. The Contractor shall provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Complete records of all letters, material submittals, shop drawing submittals, schedules and all other project documentation shall be promptly furnished to the CQC organization by the Contractor. The CQC organization shall be responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Contracting Officer.

#### 3.4.2 CQC System Manager

The Contractor shall identify as CQC System Manager an individual within the onsite work organization who shall be responsible for overall management of CQC and have the authority to act in all CQC matters for the Contractor. The CQC System Manager shall be a graduate engineer, graduate architect, or a graduate of construction management, with a minimum of 2 years construction experience on construction similar to this contract, or a construction person with a minimum of 8 years in related work. This CQC System Manager shall be on the site at all times during construction and shall be employed by the prime Contractor. The CQC System Manager shall be assigned no other duties. An alternate for the CQC System Manager shall be identified in the plan to serve in the event of the System Manager's absence. The requirements for the alternate shall be the same as for the designated CQC System Manager.

#### 3.4.3 CQC Personnel

In addition to CQC personnel specified elsewhere in the contract, the Contractor shall provide as part of the CQC organization specialized personnel to assist the CQC System Manager for the following areas: mechanical, electrical and supplemental. These individuals shall be directly employed by the prime Contractor and may not be employed by a supplier or sub-contractor on this project; be responsible to the CQC System Manager; be physically present at the construction site during work on their areas of responsibility; and have the necessary education and/or experience in accordance with the experience matrix listed herein. These individuals shall have no other duties other than quality control.

## Experience Matrix

<u>Are</u>	<u>Qualifications</u>
a. Mechanical	Person with 10 years minimum experience in installation, start up, and commissioning of mechanical systems in projects of similar complexity.
b. Electrical	Person with 10 years minimum experience in installation of building and site electrical systems in projects of similar complexity.
c. Supplemental General	Person with 10 years experience in Government contracts of similar complexity, with a knowledge of general construction experience. Person shall assist and perform initial and follow-up inspections under the direction of the CQC System Manager. This person can act for the CQC System Manager for no longer than 2 weeks at a time.

## 3.4.4 Additional Requirement

In addition to the above experience and/or education requirements the CQC System Manager shall have completed the course entitled "Construction Quality Management For Contractors". If the Contractor needs this training, it will be provided by Government personnel after award of a contract.

## 3.4.5 Organizational Changes

The Contractor shall maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, the Contractor shall revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

## 3.5 SUBMITTALS

Submittals, if needed, shall be made as specified in Section 01330 SUBMITTAL PROCEDURES. The CQC organization shall be responsible for certifying that all submittals are in compliance with the contract requirements.

## 3.6 CONTROL

Contractor Quality Control is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control

shall be conducted by the CQC System Manager for each definable feature of work as follows:

### 3.6.1 Preparatory Phase

This phase shall be performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. This phase shall include:

- a. A review of each paragraph of applicable specifications, reference codes, and standards. A copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field shall be made available by the Contractor at the preparatory inspection. These copies shall be maintained in the field and available for use by Government personnel until final acceptance of the work.
- b. A review of the contract drawings.
- c. A check to assure that all materials and/or equipment have been tested, submitted, and approved.
- d. Review of provisions that have been made to provide required control inspection and testing.
- e. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the contract.
- f. A physical examination of required materials, equipment, and sample work to assure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.
- g. A review of the appropriate activity hazard analysis to assure safety requirements are met.
- h. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.
- i. A check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.
- j. Discussion of the initial control phase.
- k. The Government shall be notified at least 48 hours in advance of beginning the preparatory control phase. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The results of the preparatory phase actions shall be documented by separate minutes prepared by the CQC System Manager and attached to the daily CQC report. The Contractor shall instruct applicable workers as to the acceptable level of workmanship required in order to meet contract



specifications.

### 3.6.2 Initial Phase

This phase shall be accomplished at the beginning of a definable feature of work. The following shall be accomplished:

- a. A check of work to ensure that it is in full compliance with contract requirements. Review minutes of the preparatory meeting.
- b. Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing.
- c. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
- d. Resolve all differences.
- e. Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
- f. The Government shall be notified at least 48 hours in advance of beginning the initial phase. Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the daily CQC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.
- g. The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

### 3.6.3 Follow-up Phase

Daily checks shall be performed to assure control activities, including control testing, are providing continued compliance with contract requirements, until completion of the particular feature of work. The checks shall be made a matter of record in the CQC documentation. Final follow-up checks shall be conducted and all deficiencies corrected prior to the start of additional features of work which may be affected by the deficient work. The Contractor shall not build upon nor conceal non-conforming work.

### 3.6.4 Additional Preparatory and Initial Phases

Additional preparatory and initial phases shall be conducted on the same definable features of work if: the quality of on-going work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity; or if other problems develop.

### 3.7 TESTS

#### 3.7.1 Testing Procedure

The Contractor shall perform specified or required tests to verify that control measures are adequate to provide a product which conforms to contract requirements. Upon request, the Contractor shall furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and/or acceptance tests when specified. The Contractor shall procure the services of a Corps of Engineers approved testing laboratory or establish an approved testing laboratory at the project site. The Contractor shall perform the following activities and record and provide the following data:

- a. Verify that testing procedures comply with contract requirements.
- b. Verify that facilities and testing equipment are available and comply with testing standards.
- c. Check test instrument calibration data against certified standards.
- d. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
- e. Results of all tests taken, both passing and failing tests, shall be recorded on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test shall be given. If approved by the Contracting Officer, actual test reports may be submitted later with a reference to the test number and date taken. An information copy of tests performed by an offsite or commercial test facility shall be provided directly to the Contracting Officer. Failure to submit timely test reports as stated may result in nonpayment for related work performed and disapproval of the test facility for this contract.

#### 3.7.2 Testing Laboratories

##### 3.7.2.1 Capability Check

The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician's testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt, and steel shall meet criteria detailed in ASTM D 3740 and ASTM E 329.

##### 3.7.2.2 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed a charge of \$3,500 to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the contract amount

due the Contractor.

### 3.7.3 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

### 3.7.4 Furnishing or Transportation of Samples for Testing

Costs incidental to the transportation of samples or materials shall be borne by the Contractor. Samples of materials for test verification and acceptance testing by the Government shall be delivered to the Corps of Engineers Division Laboratory, f.o.b., at the following address:

For delivery by mail:

USACE Research and Development Center  
ATTN: Joe Tom, CEERD-SC-E  
3909 Halls Ferry Road  
Vicksburg, MS 39180-6199

For other deliveries: Same as above.

Coordination for each specific test, exact delivery location, and dates will be made through the Area Office.

## 3.8 COMPLETION INSPECTION

### 3.8.1 Punch-Out Inspection

Near the end of the work, or any increment of the work established by a time stated in the Special Clause, "Commencement, Prosecution, and Completion of Work", or by the specifications, the CQC Manager shall conduct an inspection of the work. A punch list of items which do not conform to the approved drawings and specifications shall be prepared and included in the CQC documentation, as required by paragraph DOCUMENTATION. The list of deficiencies shall include the estimated date by which the deficiencies will be corrected. The CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Government that the facility is ready for the Government Pre-Final inspection.

### 3.8.2 Pre-Final Inspection

The Government will perform the pre-final inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. The Contractor's CQC System Manager shall ensure that all items on this list have been corrected before notifying the Government, so that a Final inspection with the customer can be scheduled. Any items noted on the Pre-Final inspection shall be corrected in a timely manner. These inspections and any deficiency corrections required by this paragraph shall be accomplished within the time

slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate completion dates.

### 3.8.3 Final Acceptance Inspection

The Contractor's Quality Control Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Representative shall be in attendance at the final acceptance inspection. Additional Government personnel including, but not limited to, those from Base/Post Civil Facility Engineer user groups, and major commands may also be in attendance. The final acceptance inspection will be formally scheduled by the Contracting Officer based upon results of the Pre-Final inspection. Notice shall be given to the Contracting Officer at least 14 days prior to the final acceptance inspection and shall include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date scheduled for the final acceptance inspection. Failure of the Contractor to have all contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the contract clause titled "Inspection of Construction".

### 3.9 DOCUMENTATION

The Contractor shall maintain current records providing factual evidence that required quality control activities and/or tests have been performed. These records shall include the work of subcontractors and suppliers and shall be on an acceptable form that includes, as a minimum, the following information:

- a. Contractor/subcontractor and their area of responsibility.
- b. Operating plant/equipment with hours worked, idle, or down for repair.
- c. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
- d. Test and/or control activities performed with results and references to specifications/drawings requirements. The control phase shall be identified (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action.
- e. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications/drawings requirements.
- f. Submittals and deliverables reviewed, with contract reference, by whom, and action taken.
- g. Offsite surveillance activities, including actions taken.

- h. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
- i. Instructions given/received and conflicts in plans and/or specifications.
- j. Contractor's verification statement.

These records shall indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in the work and workmanship comply with the contract. The original and one copy of these records in report form shall be furnished to the Government daily within 24 hours after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, one report shall be prepared and submitted for every 7 days of no work and on the last day of a no work period. All calendar days shall be accounted for throughout the life of the contract. The first report following a day of no work shall be for that day only. Reports shall be signed and dated by the CQC System Manager. The report from the CQC System Manager shall include copies of test reports and copies of reports prepared by all subordinate quality control personnel.

### 3.10 SAMPLE FORMS

Sample forms enclosed at the end of this section.

### 3.11 NOTIFICATION OF NONCOMPLIANCE

The Contracting Officer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

### 3.12 IMPLEMENTATION OF GOVERNMENT RESIDENT MANAGEMENT SYSTEM FOR CONTRACTOR QUALITY CONTROL OF CONTRACT

#### 3.12.1 Government-Furnished CQC Programming Module

The Contractor shall utilize a Government-furnished CQC Programming Module (a computerized executable file which is DOS based and operates on a minimum of 80386 IBM compatible computers). Note: A Hewlett-Packard LaserJet 4 printer (or better) is required to print the reports from this program. The Module includes a Daily CQC Reporting System form which must also be used. This form may be in addition to other Contractor desired reporting forms. However, all other such reporting forms shall be consolidated into this one Government-specified Daily CQC Report Form. The Contractor will also be required to complete Government-Furnished Module elements which include, but

are not limited to, Prime Contractor staffing; letter-codes; planned cumulative progress earnings; subcontractor information showing trade, name, address, point of contact, and insurance expiration dates; definable features of work; pay activity and activity information; required Quality Control tests tied to individual activities; planned User Schooling tied to specific specification paragraphs and contractor activities; Installed Property Listing; Transfer Property Listing; and submittal information relating to specification section, description, activity number, review period and expected procurement period. The sum of all activity values shall equal the contract amount, and all Bid Items, Options and Additives (if applicable) shall be separately identified, in accordance with the "Bid Schedule". Bid Items may include multiple activities, but activities may only be assigned to one such Bid Item. This Module shall be completed to the satisfaction of the Contracting Officer prior to any contract payment (except for Bonds, Insurance and/or Mobilization, as approved by the Contracting Officer) and shall be updated as required.

### 3.12.2 Quality Assurance Comments

During the course of the contract, the Contractor will receive various Quality Assurance comments from the Government that will reflect corrections needed to Contractor activities or reflect outstanding or future items needing the attention of the Contractor. The Contractor will acknowledge receipt of these comments by specific number reference on his Daily CQC Report, and will also reflect on his Daily CQC Report when these items are specifically completed or corrected to permit Government verification.

### 3.12.3 Contractor's Scheduling System

The Contractor's scheduling system shall include, as specific and separate activities, all Preparatory Phase Meetings (inspections); all O&M Manuals; and all Test Plans of electrical and mechanical equipment or systems that require validation testing or instructions to Government representatives.

-- End of Section --

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## SECTION 01500

## TEMPORARY CONSTRUCTION FACILITIES

02/97

## 1.1 BULLETIN BOARD, PROJECT SIGN, AND PROJECT SAFETY SIGN

## 1.1.1 Bulletin Board

Immediately upon beginning of work, the Contractor shall provide a weatherproof glass-covered bulletin board not less than 915 by 1220 mm in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the contract, Wage Rate Information poster, and other information approved by the Contracting Officer. The bulletin board shall be located at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer. Legible copies of the aforementioned data shall be displayed until work is completed. Upon completion of work the bulletin board shall be removed by and remain the property of the Contractor.

## 1.1.2 Project and Safety Signs

The requirements for the signs, their content, and location shall be as shown on the drawings. The signs shall be erected within 15 days after receipt of the notice to proceed. The data required by the safety sign shall be corrected daily, with light colored metallic or non-metallic numerals. Upon completion of the project, the signs shall be removed from the site.

## 1.2 PROTECTION AND MAINTENANCE OF TRAFFIC

During construction the Contractor shall provide access and temporary relocated roads as necessary to maintain traffic. The Contractor shall maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer.

Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment and the work, and the erection and maintenance of adequate warning, danger, and direction signs, shall be as required by the State and local authorities having jurisdiction. The traveling public shall be protected from damage to person and property. The Contractor's traffic on roads selected for hauling material to and from the site shall interfere as little as possible with public traffic. The Contractor shall investigate the adequacy of existing roads and the allowable load limit on these roads. The Contractor shall be responsible for the repair of any damage to roads caused by construction operations.

## 1.2.1 Haul Roads

The Contractor shall, at its own expense, construct access and haul roads necessary for proper prosecution of the work under this contract. Haul

roads shall be constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided. The Contractor shall provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, shall be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and hauling roads shall be subject to approval by the Contracting Officer. Lighting shall be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations. Upon completion of the work, haul roads designated by the Contracting Officer shall be removed.

#### 1.2.2 Barricades

The Contractor shall erect and maintain temporary barricades to limit public access to hazardous areas. Such barricades shall be required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Barricades shall be securely placed, clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

### 1.3 CONTRACTOR'S TEMPORARY FACILITIES

#### 1.3.1 Administrative Field Offices

The Contractor shall provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel.

#### 1.3.2 Storage Area

The Contractor shall construct a temporary 1.8 m high chain link fence around trailers and materials. The fence shall include plastic strip inserts, colored [green] [brown], so that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Trailers, materials, or equipment shall not be placed or stored outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the military boundaries. Trailers, equipment, or materials shall not be open to public view with the exception of those items which are in support of ongoing work on any given day. Materials shall not be stockpiled outside the fence in preparation for the next day's work. Mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment, shall be parked within the fenced area at the end of each work day.

#### 1.3.3 Supplemental Storage Area

Upon Contractor's request, the Contracting Officer will designate another or supplemental area for the Contractor's use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but shall be within the military boundaries. Fencing of



materials or equipment will not be required at this site; however, the Contractor shall be responsible for cleanliness and orderliness of the area used and for the security of any material or equipment stored in this area. Utilities will not be provided to this area by the Government.

#### 1.3.4 Appearance of Trailers

Trailers utilized by the Contractor for administrative or material storage purposes shall present a clean and neat exterior appearance and shall be in a state of good repair. Trailers which, in the opinion of the Contracting Officer, require exterior painting or maintenance will not be allowed on the military property.

#### 1.3.5 Maintenance of Storage Area

Fencing shall be kept in a state of good repair and proper alignment. Should the Contractor elect to traverse, with construction equipment or other vehicles, grassed or unpaved areas which are not established roadways, such areas shall be covered with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways; gravel gradation shall be at the Contractor's discretion. Grass located within the boundaries of the construction site shall be mowed for the duration of the project. Grass and vegetation along fences, buildings, under trailers, and in areas not accessible to mowers shall be edged or trimmed neatly.

#### 1.3.6 New Building

In the event a new building is constructed for the temporary project field office, it shall be a minimum 3.6 m in width, 5 m in length and have a minimum of 2.1 m headroom. It shall be equipped with approved electrical wiring, at least one double convenience outlet and the required switches and fuses to provide 110-120 volt power. It shall be provided with a work table with stool, desk with chair, two additional chairs, and one legal size file cabinet that can be locked. The building shall be waterproof, shall be supplied with heater, shall have a minimum of two doors, electric lights, a telephone, a battery operated smoke detector alarm, a sufficient number of adjustable windows for adequate light and ventilation, and a supply of approved drinking water. Approved sanitary facilities shall be furnished. The windows and doors shall be screened and the doors provided with dead bolt type locking devices or a padlock and heavy duty hasp bolted to the door. Door hinge pins shall be non-removable. The windows shall be arranged to open and to be securely fastened from the inside. Glass panels in windows shall be protected by bars or heavy mesh screens to prevent easy access to the building through these panels. In warm weather, air conditioning capable of maintaining the office at 50 percent relative humidity and a room temperature 11 degrees C below the outside temperature when the outside temperature is 35 degrees C, shall be furnished. Any new building erected for a temporary field office shall be maintained by the Contractor during the life of the contract and upon completion and acceptance of the work shall become the property of the Contractor and shall be removed from the site. All charges for telephone service for the temporary field office shall be borne by the Contractor, including long distance charges up to a maximum of \$75.00 per month.

### 1.3.7 Security Provisions

Adequate outside security lighting shall be provided at the Contractor's temporary facilities. The Contractor shall be responsible for the security of its own equipment; in addition, the Contractor shall notify the appropriate law enforcement agency requesting periodic security checks of the temporary project field office.

### 1.4 ACCOMMODATIONS FOR GOVERNMENT INSPECTORS

The Contractor shall furnish a temporary office facility approximately 14 feet by 70 feet with a minimum of 980 square feet of floor space. It shall be located where directed and shall be reserved for Government personnel only. The site will include four parking spaces. Cooled bottled drinking water facilities, adequate lighting, local commercial telephone service, air conditioning, heating equipment, and a toilet room with water closet and lavatory with sewage facilities shall be furnished and maintained by the Contractor. All windows shall have operable blinds and the office shall include at least four coat hooks to be installed where directed. The office facility shall be divided to include two office areas and a common area. The office the the door shall have a dedicated phone line and computer connection. The second office and common area can share a phone line and computer connection. Both offices shall include a desk, chair, ten feet of shelving located where directed, and one legal size filing cabinet with four drawers (the office without the door will have two legal size filing cabinets). A counter will be provided on the wall behind the desks as a work area for 1/2-size drawings. The common area will include a telephone, a computer work station, a plain paper fax machine, a plan table large enough to accommodate a full size set of drawings with seat, a white marker board, a copier capable of automatic feed and sorting, one plan rack, and three chairs. A fold-up table (3 feet x 8 feet) with 4 metal folding chairs will be furnished for use in job site meetings. Used furniture, in good condition, will be acceptable. Entrance doors shall be equipped with a substantial lock. The trailer site shall be connected to building 2204 by a Contractor-furnished T-1 data circuit. The contractor shall also furnish a 3com 4-port hub (model # OfficeConnect Hub TP40, 4-100BTX) and 2 - Cisco routers (model # 1601-R) with appropriate interface cards, one at the trailer site and one at building 2204. The Contractor shall insure that a CSU/DSU is either furnished by the telephone company or integrated with the routers. All connecting cables from the T-1 demarc to the routers and from the routers to the hub will be furnished by the Contractor. The Contractor shall provide janitor service (the office shall be cleaned weekly), fuel for the heating facilities, electricity, telephone and water, all at no cost to the Government, except the Contractor will not be liable for Government long-distance calls. The entire facility, including furniture, will remain the property of the contractor and shall be removed from the site after completion of the work.

### 1.5 PLANT COMMUNICATION

Whenever the Contractor has the individual elements of its plant so located that operation by normal voice between these elements is not satisfactory, the Contractor shall install a satisfactory means of communication, such as telephone or other suitable devices. The devices shall be made available

for use by Government personnel.

#### 1.6 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, the Contractor shall furnish and erect temporary project safety fencing at the work site. The safety fencing shall be a high visibility orange colored, high density polyethylene grid or approved equal, a minimum of 1.1 m high, supported and tightly secured to steel posts located on maximum 3 m centers, constructed at the approved location. The safety fencing shall be maintained by the Contractor during the life of the contract and, upon completion and acceptance of the work, shall become the property of the Contractor and shall be removed from the work site.

#### 1.7 CLEANUP

Construction debris, waste materials, packaging material and the like shall be removed from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways shall be cleaned away. Materials resulting from demolition activities which are salvageable shall be stored within the fenced area described above or at the supplemental storage area. Stored material not in trailers, whether new or salvaged, shall be neatly stacked when stored.

#### 1.8 RESTORATION OF STORAGE AREA

Upon completion of the project and after removal of trailers, materials, and equipment from within the fenced area, the fence shall be removed and will become the property of the Contractor. Areas used by the Contractor for the storage of equipment or material, or other use, shall be restored to the original or better condition. Gravel used to traverse grassed areas shall be removed and the area restored to its original condition, including top soil and seeding as necessary.

-- End of Section --

## SECTION 01780

## CLOSEOUT SUBMITTALS

**11/99**

## PART 1 GENERAL

## 1.1 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES.

## SD-18 Records

As-Built Contract Drawings; GA-RE.

Drawings showing final as-built conditions of the project. The final as-built contract drawings shall consist of one set of electronic CADD drawing files in the specified format, one set of mylar drawings, and two sets of the approved red-line as-built drawings.

As-Built Shop Drawings; GA-RE.

As-Built Shop Drawings: Upon completion of the work under this contract, the Contractor shall furnish five complete sets or one complete set of reproducibles of all shop drawings as finally approved. These drawings shall show all changes and revisions made up to the time the equipment is completed and accepted. The quality of the reproducibles and prints is subject to approval.

As-Built Record of Equipment and Materials; GA-RE.

Two copies of the record listing the as-built materials and equipment incorporated into the construction of the project.

Warranty Management Plan; GA-RE.

One set of the warranty management plan containing information relevant to the warranty of materials and equipment incorporated into the construction project, including the starting date of warranty of construction. The Contractor shall furnish with each warranty the name, address, and telephone number of each of the guarantor's representatives nearest to the project location.

Warranty Tags; GA-RE.

Two record copies of the warranty tags showing the layout and design.

Final Clean-Up; GA-RE.

Two copies of the listing of completed final clean-up items.

## 1.2 PROJECT RECORD DOCUMENTS

### 1.2.1 As-Built Drawings

This paragraph covers as-built drawings complete, as a requirement of the contract. The terms "drawings," "contract drawings," "drawing files," "working as-built drawings" and "final as-built drawings" refer to contract drawings which are revised to be used for final as-built drawings.

#### 1.2.1.1 Government Furnished Materials

One set of electronic CADD files in the specified software and format revised to reflect all bid amendments will be provided by the Government. The Government will provide to the Contractor, within 30 calendar days after Notice of Award, copies of the CADD computer files of the contract drawings for the production of as-built drawings. These files will be in Bentley Microstation format. The Government provides no warranty, expressed or implied, of the CADD computer files. The Contractor shall assume all responsibility to verify the CADD drawing files. The Contractor will not utilize the CADD drawing computer files to resolve dimensional or other discrepancies. The Government will not guarantee the measurable accuracy of the CADD drawing computer files.

#### 1.2.1.2 Monthly As-Built Review Meeting

A monthly as-built review meeting will be conducted during the construction project. Each member of the construction team will attend the meeting and provide information or documentation as required. The meeting will be conducted in a mutually agreed upon location. To minimize difficulty in coordinating schedules, efforts will be made for a standing meeting in the same location, at the same time, and on the same day of the week each month.

- a. The Government will chair the meeting and serve as the information conduit.
- b. The Government will provide an agenda for the meeting.
- c. The Contractor shall bring two updated CDs (or diskettes) to the meeting.
- d. The Contractor shall bring current redline drawings to the meeting.
- e. The Contractor shall display updated CADD as-built files on screen, demonstrating that CADD files match features on redline drawings, and making changes if necessary.
- f. The Contractor shall leave one CD (or diskette) with the Government. The Contractor shall have updated this copy to include any changes made during the meeting.
- g. The Contractor shall ensure that all design/construction and environmental drawings in the Bentley Microstation DGN file format, compatible with Ft. Leonard Wood's CADD system, follow the Release 1.8 of the Tri-Service CADD Standard, that an electronic copy of the above mentioned standard is furnished, and that all submittals are delivered on CD-ROM or 1.44 MB diskette.
- h. For features exterior to primary facilities, the Government

shall ensure the design file, working units and Cartesian coordinates allow for graphics to be geographically located in the Universal Traverse Macerator (UTM) zone 15 datum.

#### 1.2.1.3 Exterior Utility Systems

At intervals of 30 days from the time work is begun on new utility systems or on revising existing systems, as-built CADD files shall be submitted showing the condition of new and altered utility systems. The as-built exterior utility drawings shall show locations and elevations of all underground new and existing utilities encountered, including dimensions from permanent structures and/or survey locations. **The submittal requirements for as-built utility drawings shall be shown as separate activities on the Contractor-prepared network analysis and in the Submittal Register.**

#### 1.2.1.4 Working As-Built and Final As-Built Drawings

The Contractor shall revise three (3) sets of paper drawings by red-line process to show the as-built conditions during the prosecution of the project. These working as-built marked drawings shall be kept current on a daily basis and at least one set shall be available on the jobsite at all times. Changes from the contract plans which are made in the work or additional information which might be uncovered in the course of construction shall be accurately and neatly recorded as they occur by means of details and notes. **In addition, the Contractor shall indicate on the as-built drawings the brand-name, description, location, and quantity of any and all materials used which contain asbestos** Final as-built drawings shall be prepared after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (Foundations, Utilities, Structural Steel, etc., as appropriate for the project). The working as-built marked prints and final as-built drawings will be jointly reviewed for accuracy and completeness by the Contracting Officer and the Contractor prior to submission of each monthly pay estimate. If the Contractor fails to maintain the working and final as-built drawings as specified herein, the Contracting Officer will deduct from the monthly progress payment an amount representing the estimated cost of maintaining the as-built drawings. This monthly deduction will continue until an agreement can be reached between the Contracting Officer and the Contractor regarding the accuracy and completeness of updated drawings. The working and final as-built drawings shall show, but shall not be limited to, the following information:

a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, the as-built drawings shall show, by offset dimensions to two permanently fixed surface features, the end of each run including each change in direction. Valves, splice boxes and similar appurtenances shall be located by dimensioning along the utility run from a reference point. The average depth below the surface of each run shall also be recorded.

b. The location and dimensions of any changes within the building structure.

c. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.

d. Changes in details of design or additional information obtained from working drawings specified to be prepared and/or furnished by the Contractor; including but not limited to fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment foundations, etc.

e. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.

f. Changes or modifications which result from the final inspection.

g. Where contract drawings or specifications present options, only the option selected for construction shall be shown on the final as-built prints.

h. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.

i. Modifications (change order price shall include the Contractor's cost to change working and final as-built drawings to reflect modifications) and compliance with the following procedures.

(1) Directions in the modification for posting descriptive changes, if provided, shall be followed.

(2) A Modification Circle shall be placed at the location of each revision whether it is a revision, an addition or a deletion. The Modification Circle size shall be 12.7 mm diameter unless the area where the circle is to be placed is crowded. Smaller size circle shall be used for crowded areas. These circle and associated revision cloud shall be placed on Level/Layer 63 per the TRI-Service Standards.

(3) For new details or sections which are added to a drawing, a Modification Circle shall be placed by the detail or section title.

(4) For minor changes, a Modification Circle shall be placed by the area changed on the drawing (each location).

(5) For major changes to a drawing, a Modification Circle shall be placed by the title of the affected plan, section, or detail at each location.

(6) For changes to schedules or drawings, a Modification Circle shall be placed either by the schedule heading or by the change in the schedule.

#### 1.2.1.5 Drawing Preparation

The as-built drawings shall be modified as may be necessary to correctly show the features of the project as it has been constructed by bringing the

contract set into agreement with approved working as-built prints, and adding such additional drawings as may be necessary. These working as-built marked prints shall be neat, legible and accurate. These drawings are part of the permanent records of this project and shall be returned to the Contracting Officer after approval by the Government. Any drawings damaged or lost by the Contractor shall be satisfactorily replaced by the Contractor at no expense to the Government.

#### 1.2.1.6 Computer Aided Design and Drafting (CADD) Drawings

Only personnel trained with a minimum of 3 years in the preparation of Bentley CADD drawings and the Tri-service Standards shall be employed to modify the contract drawings or prepare additional new drawings. Additions and corrections to the contract drawings shall be equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols shall be the same as the original line colors, line weights, lettering, layering conventions, and symbols. If additional drawings are required, they shall be prepared using the specified electronic file format applying the same graphic standards specified for original drawings. **The Contractor will be provided a copy of the Tri-Service CADD standards to facilitate his efforts in the maintenance of design files** The title block and drawing border to be used for any new final as-built drawings shall be identical to that used on the contract drawings. Additions and corrections to the contract drawings shall be accomplished using CADD files. The electronic files will be supplied on compact disc, read-only memory (CD-ROM). The Contractor shall be responsible for providing all program files and hardware necessary to prepare final as-built drawings. The Contracting Officer will review final as-built drawings for accuracy and the Contractor shall make required corrections, changes, additions, and deletions.

b. The Contract Drawing files shall have all changes made on the layer/level as the original item being revised, deleted or added to.

c. When final revisions have been completed, the cover sheet drawing shall show the wording "RECORD DRAWING AS-BUILT" followed by the name of the Contractor in letters at least 5 mm high. All other contract drawings shall be marked either "AS-Built" drawing denoting no revisions on the sheet or "Revised As-Built" denoting one or more revisions. Original contract drawings shall be dated in the revision block.

d. Within 20 days after Government approval of all of the working as-built drawings for a phase of work, the Contractor shall prepare the final CADD as-built drawings for that phase of work and submit two sets of blue-lined prints of these drawings for Government review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 10 days the Contractor shall revise the CADD files accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 20 days of substantial completion of all phases of work, the Contractor shall submit the final as-built drawing package for the entire project. The submittal shall consist of one set of electronic files on compact disc read-only memory (CD-ROM), one set of **3 mil, digital, erasabl** 24-inch by 36-inch mylars, a sheet index showing sufficient planimetric data to indicate the



geographical location of the project, and two sets of the approved red-line as-built drawings. They shall be complete in all details and identical in form and function to the contract drawing files supplied by the Government. Any transactions or adjustments necessary to accomplish this is the responsibility of the Contractor. The Government reserves the right to reject any drawing files it deems incompatible with the customer's CADD system. Paper prints, drawing files and storage media submitted will become the property of the Government upon final approval. Failure to submit final as-built drawing files and marked prints as specified shall be cause for withholding any payment due the Contractor under this contract. Approval and acceptance of final as-built drawings shall be accomplished before final payment is made to the Contractor.

e. Within 60 days after turning over the facility, the Contractor shall provide to the Government as-built CADD files containing all of the red-line mark-ups incorporated and reflecting the completed as-built conditions of the project, including buildings, exterior utility systems, and all other features.

#### 1.2.1.7 Payment

No separate payment will be made for as-built drawings required under this contract, and all costs accrued in connection with such drawings shall be considered a subsidiary obligation of the Contractor.

#### 1.2.2 As-Built Record of Equipment and Materials

The Contractor shall furnish one copy copies of preliminary record of equipment and materials used on the project 120 days prior to final inspection. This preliminary submittal will be reviewed and returned within 30 days with Government comments. Two sets of final record of equipment and materials shall be submitted 10 days prior to a final inspection. The designations shall be keyed to the related area depicted on the contract drawings. This listing shall be inputted and updated as part of the Contractor Module of the Resident Management System. The record shall list the following data:

##### RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA

Description	Specification	Manufacturer	Composition	Where
Price	Section	and Catalog, Model, and Serial Number	and Size	Used

#### 1.2.3 Final Approved AS-Built Shop Drawings

The Contractor shall furnish final approved project AS-Built shop drawings 90 days prior to the Final Inspection of any one part of the completed facility. The Contractor shall furnish five complete sets of prints or one complete set of reproducibles of all shop drawings as finally approved. These drawings shall show all changes and revisions made up to the time the equipment is completed and accepted.

#### 1.2.4 Construction Contract Specifications

The Contractor shall furnish final as-built construction contract specifications, including modifications thereto, 30 days after transfer of the completed facility.

### 1.3 WARRANTY MANAGEMENT

#### 1.3.1 Warranty Management Plan

The Contractor shall develop a warranty management plan which shall contain information relevant to the clause Warranty of Construction in Section 00800. At least 30 days before the planned pre-warranty conference, the Contractor shall submit the warranty management plan for Government approval. The warranty management plan shall include all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan shall be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below shall include due date and whether item has been submitted or was accomplished. Warranty information made available during the construction phase shall be submitted to the Contracting Officer for approval prior to each monthly pay estimate. Approved information shall be assembled in a binder and shall be turned over to the Government upon acceptance of the work. The construction warranty period shall begin on the date of project acceptance and shall continue for the full product warranty period. A joint 4 month and 9 month warranty inspection shall be conducted, measured from time of acceptance, by the Contractor, Contracting Officer and the Customer Representative. Information contained in the warranty management plan shall include, but shall not be limited to, the following:

a. Roles and responsibilities of all personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, subcontractors, manufacturers or suppliers involved.

b. Listing and status of delivery of all Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and for all commissioned systems such as fire protection and alarm systems, sprinkler systems, lightning protection systems, etc.

c. A list for each warranted equipment, item, feature of construction or system indicating:

1. Name of item.
2. Model and serial numbers.
3. Location where installed.
4. Name and phone numbers of manufacturers or suppliers.
5. Names, addresses and telephone numbers of sources of spare parts.
6. Warranties and terms of warranty. This shall include one-year overall warranty of construction. Items which have extended warranties shall be indicated with separate warranty expiration dates.
7. Cross-reference to warranty certificates as applicable.

8. Starting point and duration of warranty period.
9. Summary of maintenance procedures required to continue the warranty in force.
10. Cross-reference to specific pertinent Operation and Maintenance manuals.
11. Organization, names and phone numbers of persons to call for warranty service.
12. Typical response time and repair time expected for various warranted equipment.

d. The Contractor's plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.

e. Procedure and status of tagging of all equipment covered by extended warranties.

f. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

#### 1.3.2 Performance Bond

The Contractor's Performance Bond shall remain effective throughout the construction period.

a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

c. Following oral or written notification of required construction warranty repair work, the Contractor shall respond in a timely manner. Written verification will follow oral instructions. Failure of the Contractor to respond will be cause for the Contracting Officer to proceed against the Contractor.

#### 1.3.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, the Contractor shall meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. Communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty shall be established/reviewed at this meeting. In connection with these requirements and at the time of the Contractor's quality control completion inspection, the Contractor shall furnish the name, telephone number and address of a licensed

and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact will be located within the local service area of the warranted construction, shall be continuously available, and shall be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

#### 1.3.4 Contractor's Response to Construction Warranty Service Requirements

Following oral or written notification by the Contracting Officer, the Contractor shall respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. The Contractor shall submit a report on any warranty item that has been repaired during the warranty period. The report shall include the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the time frames specified, the Government will perform the work and backcharge the construction warranty payment item established.

a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

c. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.

d. The "Construction Warranty Service Priority List" is as follows:

##### Code 1-Air Conditioning Systems

- (1) Recreational support.
- (2) Air conditioning leak in part of building, if causing damage.
- (3) Air conditioning system not cooling properly.

##### Code 1-Doors

- (1) Overhead doors not operational, causing a security, fire, or safety problem.
- (2) Interior, exterior personnel doors or hardware, not functioning properly, causing a security, fire, or safety problem.

##### Code 3-Doors

- (1) Overhead doors not operational.
- (2) Interior/exterior personnel doors or hardware not functioning properly.

##### Code 1-Electrical

- (1) Power failure (entire area or any building operational after 1600 hours).
- (2) Security lights

(3) Smoke detectors

Code 2-Electrical

- (1) Power failure (no power to a room or part of building).
- (2) Receptacle and lights (in a room or part of building).

Code 3-Electrical

Street lights.

Code 1-Gas

- (1) Leaks and breaks.
- (2) No gas to family housing unit or cantonment area.

Code 1-Heat

- (1). Area power failure affecting heat.
- (2). Heater in unit not working.

Code 2-Kitchen Equipment

- (1) Dishwasher not operating properly.
- (2) All other equipment hampering preparation of a meal.

Code 1-Plumbing

- (1) Hot water heater failure.
- (2) Leaking water supply pipes.

Code 2-Plumbing

- (1) Flush valves not operating properly.
- (2) Fixture drain, supply line to commode, or any water pipe leaking.
- (3) Commode leaking at base.

Code 3 -Plumbing

Leaky faucets.

Code 3-Interior

- (1) Floors damaged.
- (2) Paint chipping or peeling.
- (3) Casework.

Code 1-Roof Leaks

Temporary repairs will be made where major damage to property is occurring.

Code 2-Roof Leaks

Where major damage to property is not occurring, check for location of leak during rain and complete repairs on a Code 2 basis.

Code 2-Water (Exterior)

No water to facility.

Code 2-Water (Hot)

No hot water in portion of building listed.

Code 3-All other work not listed above.

### 1.3.5 Warranty Tags

At the time of installation, each warranted item shall be tagged with a durable, oil and water resistant tag approved by the Contracting Officer. Each tag shall be attached with a copper wire and shall be sprayed with a silicone waterproof coating. The date of acceptance and the QC signature shall remain blank until project is accepted for beneficial occupancy. The tag shall show the following information.

- a. Type of product/material\_\_\_\_\_.
- b. Model number\_\_\_\_\_.
- c. Serial number\_\_\_\_\_.
- d. Contract number\_\_\_\_\_.
- e. Warranty period\_\_\_\_\_from\_\_\_\_\_to\_\_\_\_\_.
- f. Inspector's signature\_\_\_\_\_.
- g. Construction Contractor\_\_\_\_\_.
- Address\_\_\_\_\_.
- Telephone number\_\_\_\_\_.
- h. Warranty contact\_\_\_\_\_.
- Address\_\_\_\_\_.
- Telephone number\_\_\_\_\_.
- i. Warranty response time priority code\_\_\_\_\_.
- j. WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.

### 1.4 MECHANICAL TESTING, ADJUSTING, BALANCING, AND COMMISSIONING

Prior to final inspection and transfer of the completed facility; all reports, statements, certificates, and completed checklists for testing, adjusting, balancing, and commissioning of mechanical systems shall be submitted to and approved by the Contracting Officer as specified in applicable technical specification sections.

### 1.5 OPERATION AND MAINTENANCE MANUALS

Operation manuals and maintenance manuals shall be submitted as specified and shall be submitted 90 days prior to acceptance of any part of the completed facility. Operation manuals and maintenance manuals provided in a common volume shall be clearly differentiated and shall be separately indexed.

## 1.6 FINAL CLEANING

The premises shall be left broom clean. Stains, foreign substances, and temporary labels shall be removed from surfaces. Carpet and soft surfaces shall be vacuumed. Equipment and fixtures shall be cleaned to a sanitary condition. Filters of operating equipment shall be replaced. Debris shall be removed from roofs, drainage systems, gutters, and downspouts. Paved areas shall be swept and landscaped areas shall be raked clean. The site shall have waste, surplus materials, and rubbish removed. The project area shall have temporary structures, barricades, project signs, and construction facilities removed. A list of completed clean-up items shall be submitted on the day of final inspection.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

-- End of Section --

## DIVISION 2 – SITE WORK

02220	Demolition
02230	Clearing and Grubbing
02245	Riprap Placement
02300	Earthwork
02315	Excavation, Filling and Backfilling for Buildings
02316	Excavation, Trenching, and Backfilling for Utilities Systems
02510	Water Distribution System
02531	Sanitary Sewers
02555	Prefabricated Underground Heating/Cooling Distribution System
02570	Valve Manholes and Piping and Equipment in Valve Manholes
02620	Subdrainage System
02630	Storm-Drainage System
02712	Lime-Modified Subgrade
02714	Drainage Layer
02721	Subbase Courses
02722	Aggregate and/or Graded-Crushed Aggregate Base Course
02731	Aggregate Surface Course
02741	Hot-Mix Asphalt (HMA) for Roads
02748	Bituminous Tack and Prime Coats
02754	Concrete Pavements for Small Projects
02760	Field Molded Sealants for Sealing Joints in Rigid Pavements
02763	Pavement Markings
02770	Concrete Sidewalks and Curbs and Gutters
02832	Segmental Concrete Block Retaining Wall
02833	Synthetic Sports Surface
02921	Seeding
02930	Exterior Planting



## SECTION 02220

## DEMOLITION

12/97

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ENGINEERING MANUALS (EM)

EM 385-1-1 (1996) U.S. Army Corps of Engineers Safety and Health Requirements Manual

## 1.2 GENERAL REQUIREMENTS

The work includes demolition, salvage of identified items and materials, and removal of resulting rubbish and debris. Rubbish and debris shall be removed from Government property daily, unless otherwise directed, to avoid accumulation at the demolition site. Materials that cannot be removed daily shall be stored in areas specified by the Contracting Officer. In the interest of occupational safety and health, the work shall be performed in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections. In the interest of conservation, salvage shall be pursued to the maximum extent possible; salvaged items and materials shall be disposed of as specified.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

## 1.4 DUST CONTROL

The amount of dust resulting from demolition shall be controlled to prevent the spread of dust to occupied portions of the construction site and to avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create, hazardous or objectionable

conditions such as ice, flooding and pollution.

## 1.5 PROTECTION

### 1.5.1 Protection of Personnel

During the demolition work the Contractor shall continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

### 1.5.2 Protection of Structures

Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, shall remain standing without additional bracing, shoring, or lateral support until demolished, unless directed otherwise by the Contracting Officer. The Contractor shall ensure that no elements determined to be unstable are left unsupported and shall be responsible for placing and securing bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

### 1.5.3 Protection of Existing Property

Before beginning any demolition work, the Contractor shall survey the site and examine the drawings and specifications to determine the extent of the work. The Contractor shall take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government; any damaged items shall be repaired or replaced as approved by the Contracting Officer. The Contractor shall coordinate the work of this section with all other work and shall construct and maintain shoring, bracing, and supports as required. The Contractor shall ensure that structural elements are not overloaded and shall be responsible for increasing structural supports or adding new supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

### 1.5.4 Protection From the Weather

The interior of buildings to remain; salvageable materials and equipment shall be protected from the weather at all times.

### 1.5.5 Protection of Trees

Trees within the project site which might be damaged during demolition, and which are indicated to be left in place, shall be protected by a 1.8 m (6 foot) high fence. The fence shall be securely erected a minimum of 1.5 m from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Any tree designated to remain that is damaged during the work under this contract shall be replaced in kind or as approved by the

Contracting Officer.

1.5.6 Environmental Protection

The work shall comply with the requirements of Section 01410 ENVIRONMENT PROTECTION.

1.6 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.7 USE OF EXPLOSIVES

Use of explosives will not be permitted.

1.8 AVAILABILITY OF WORK AREAS

The area within the construction limits shown on the contract drawings will be available after receipt of notice to proceed.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.1 EXISTING STRUCTURES

Existing structures indicated shall be removed completely.

3.2 UTILITIES

Existing utilities shall be removed as indicated. When utility lines are encountered that are not indicated on the drawings, the Contracting Officer shall be notified prior to further work in that area.

3.3 FILLING

Holes, open basements and other hazardous openings shall be filled in accordance with Section 02315.

3.4 DISPOSITION OF MATERIAL

Title to material and equipment to be demolished, except Government salvage and historical items, is vested in the Contractor upon receipt of notice to proceed. The Government will not be responsible for the condition, loss or damage to such property after notice to proceed.

3.4.1 Salvageable Items and Material

Contractor shall salvage items and material to the maximum extent possible.

3.4.1.1 Material Salvaged for the Contractor

Material salvaged for the Contractor shall be stored as approved by the

Contracting Officer and shall be removed from Government property before completion of the contract. Material salvaged for the Contractor shall not be sold on the site.

#### 3.4.1.2 Items Salvaged for the Government

Salvaged items to remain the property of the Government shall be removed in a manner to prevent damage, and packed or crated to protect the items from damage while in storage or during shipment. Items damaged during removal or storage shall be repaired or replaced to match existing items. Containers shall be properly identified as to contents. The following items reserved as property of the Government shall be delivered to the areas designated.

#### 3.4.1.3 Items Salvaged for the Using Service

Not Used

#### 3.4.2 Unsalvageable Material

Concrete, masonry, and other noncombustible material, except concrete permitted to remain in place, shall be disposed of in the disposal area located on the drawings. After disposal is completed, the disposal area shall be uniformly graded to drain. Combustible material shall be disposed of in a sanitary fill area located off the post.

#### 3.5 CLEAN UP

Debris and rubbish shall be removed from basement and similar excavations. Debris shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

#### 3.6 PAVEMENTS

Existing pavements designated for removal shall be saw cut and removed in accordance with the details shown on the drawings and to the limits and depths indicated on the drawings.

-- End of Section --

## SECTION 02230

## CLEARING AND GRUBBING

06/97

## PART 1 GENERAL

## 1.1 DEFINITIONS

## 1.1.1 Clearing

Clearing shall consist of the felling, trimming, and cutting of trees into sections and the satisfactory disposal of the trees and other vegetation designated for removal, including down timber, snags, brush, and rubbish occurring in the areas to be cleared.

## 1.1.2 Grubbing

Grubbing shall consist of the removal and disposal of stumps, roots larger than 75 mm in diameter, and matted roots from the designated grubbing areas.

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

## PART 2 PRODUCTS (Not Applicable)

## PART 3 EXECUTION

## 3.1 CLEARING

Trees, stumps, roots, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the original ground surface, except such trees and vegetation as may be indicated or directed to be left standing. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 40 mm or more in diameter and shall be trimmed of all branches the heights indicated or directed. Limbs and branches to be trimmed shall be neatly cut close to the bole of the tree or main branches. Cuts more than 40 mm in diameter shall be painted with an approved tree-wound paint. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations by the erection of barriers or by such other means as the

circumstances require. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work.

### 3.2 GRUBBING

Material to be grubbed, together with logs and other organic or metallic debris not suitable for foundation purposes, shall be removed to a depth of not less than 0.5 m below the original surface level of the ground in areas indicated to be grubbed and in areas indicated as construction areas under this contract, such as areas for buildings, and areas to be paved. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform with the original adjacent surface of the ground.

### 3.3 TREE REMOVAL

Where indicated or directed, trees and stumps that are designated as trees shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots as specified in paragraph GRUBBING. Trees shall be disposed of as specified in paragraph DISPOSAL OF MATERIALS.

### 3.4 DISPOSAL OF MATERIALS

#### 3.4.1 Salable Timber

All felled timber from which saw logs, pulpwood, posts, poles, ties, mine props, or cordwood can be produced and which is 75 mm or larger shall be considered as salable timber, and shall be trimmed of limbs and tops, sawed into salable lengths of 2.3 meters, and stockpiled at locations shown on the drawings. Timber less than 75 mm in diameter shall be converted to wood chips for use as mulch and delivered to the location shown on drawings.

#### 3.4.1 Materials Other Than Salable Timber

Logs, stumps, roots, brush, rotten wood, and other refuse from the clearing and grubbing operations, except for salable timber, shall be disposed of at the location shown on the drawing.

-- End of Section --

## SECTION 02245

## RIPRAP PLACEMENT

04/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

## 1.3 SUMMARY

The work covered by this section consists of furnishing all plant, labor, equipment and materials, and performing all operations in connection with the construction of stone protection for storm drain outlets in accordance with these specifications and as shown on the plans as directed by the Contracting Officer. Stone protection material shall consist of all stone to be furnished for riprap, and bedding material. The Contractor shall also control operations during production of stone protection material as to insure that the material delivered and placed will meet all specification requirements. The quarry operators shall be responsible for operating all quarries and for conditioning the area after operations are complete, in accordance with all applicable Federal, State, and Local laws and regulations.

## PART 2 PRODUCTS

## 2.1 RIPRAP

Riprap shall consist of sound and durable stone, cobbles, spalls, or broken concrete. The material shall have a maximum size of 457 mm and be reasonably well-graded between the maximum size stone permitted and 75 mm stone, with not more than five percent by weight smaller than the 75 mm

size. The least dimension of a stone shall be considered its size.

### PART 3 EXECUTION

#### 3.1 BEDDING MATERIAL

##### 3.1.1 General

Bedding composed of the specified bedding material shall be placed on the prepared base where required within the limits and thickness shown on the drawings or as staked in the field, to form a backing for the riprap protection. Gradation tests shall be performed on this material after it has been placed on the slope from locations directed by the Contracting Officer. Gradations shall be within the following limits:

##### Gradations

Sieve Size	Precast Passing by Weight
100 mm	100
75 mm	75-95
20 mm	40-60
10 mm	20-40
#4	5-20

##### 3.1.2 Quality

Bedding material shall be at least equal in quality to that of the stone used for riprap and shall be well graded between the sizes specified. Bedding material shall be quarried stone, crushed cobbles, and crushed gravel consisting of particles having at least one fractured face. The material shall be composed of tough, durable particles, shall be reasonably free from thin, flat and elongated pieces, and shall contain no organic matter nor soft, friable particles in quantities considered objectionable by the Contracting Officer.

##### 3.1.3 Placement

Bedding material shall be spread uniformly on the prepared base in a satisfactory manner to the slope lines, thickness, and grades indicated on the drawings or as directed. Placing of material by methods which will tend to segregate particle sizes within the bedding will not be permitted. Any damage to the surface of the bedding foundation during placing of the bedding shall be repaired before proceeding with the work. Compaction of the bedding material will not be required but it shall be finished to present a reasonably even surface free from depressions, mounds, or windrows.

#### 3.2 RIPRAP

Riprap shall be placed on the bedding material within the limits shown on the drawings or otherwise required by the Contracting Officer. The riprap shall consist of stone meeting the requirements herein before specified and shall be in pieces approximately rectangular in cross section, free from thin slabby pieces having a maximum dimension more than four times the least dimensions. Stone for riprap shall be reasonably well graded from coarse to



fine. Quarry operations shall be controlled to produce a reasonably well-graded stone of required size, and the Contracting Officer may require changes as necessary to produce the required product. The Contactor's operations shall be conducted in a manner that will produce stone meeting the requirements specified and shall include selective quarrying, and loading as required. Riprap placement shall follow placement of bedding material.

-- End of Section --

## SECTION 02300

EARTHWORK  
12/97

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

- |              |  |
|--------------|--|
| AASHTO T 180 | (1997) Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and an 457 mm (18-in) Drop |
| AASHTO T 224 | (1996) Correction for Coarse Particles in the Soil Compaction Test                                   |

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- |             |  |
|-------------|--|
| ASTM C 136  | (1996a) Sieve Analysis of Fine and Coarse Aggregates   |
| ASTM D 422  | (1963; R 1998) Particle-Size Analysis of Soils   |
| ASTM D 1140 | (1997) Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve  |
| ASTM D 1556 | (1990; R 1996el) Density and Unit Weight of Soil in Place by the Sand-Cone Method  |
| ASTM D 1557 | (1991; R 1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.)) |
| ASTM D 2167 | (1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method   |
| ASTM D 2487 | (1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)                                   |
| ASTM D 2922 | (1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)  |
| ASTM D 2937 | (1994) Density of Soil in Place by the Drive-Cylinder Method   |

ASTM D 3017 (1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

ASTM D 4318 (1998) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

## 1.2 DEFINITIONS

### 1.2.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, SP-SC, CL, ML, CL-ML. Satisfactory materials for grading shall be comprised of stones less than 200 mm, except for fill material for pavements and railroads which shall be comprised of stones less than 75 mm in any dimension.

### 1.2.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. The Contracting Officer shall be notified of any contaminated materials.

### 1.2.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Testing required for classifying materials shall be in accordance with ASTM D 4318, ASTM C 136, ASTM D 422, and ASTM D 1140.

### 1.2.4 Degree of Compaction

Degree of compaction required, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated as a percent of laboratory maximum density.

### 1.2.5 Topsoil

Material suitable for topsoils obtained from excavations is defined as selectively excavated natural, friable soil that is representative of soil in the vicinity that produces heavy growths of crops, grass or other vegetation and is reasonably free from underlying subsoil, clay lumps, objectionable weeds, litter, brush, matted roots, toxic substances or any material that might be harmful to plant growth or be a hindrance to grading, planting or maintenance operations. Soil from ditch bottoms, drained ponds, eroded areas, or soil which is excessively wet or saturated is not acceptable. topsoil shall not contain more than five percent by volume of

stones, stumps or other objects larger than 25 mm. Topsoil shall not be excessively acid or alkaline (pH value 6.0 to 7.5). Topsoil shall contain 5 to 20 percent organic matter as determined by the organic carbon 6A chemical analysis method described in USDA Soil Survey Investigation Report No. 1. Topsoil shall be approved by the Contracting Officer.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-03 Product Data

##### Earthwork

Procedure and location for disposal of unused satisfactory material.  
Blasting plan when blasting is permitted. Proposed source of borrow material.

Notification of encountering rock in the project. Advance notice on the opening of excavation or borrow areas. Advance notice on shoulder construction for rigid pavements.

#### SD-06 Test Reports

##### Testing

Within 24 hours of conclusion of physical tests, \_\_\_\_\_ copies of test results, including calibration curves and results of calibration tests.

#### SD-07 Certificates

##### Testing

Qualifications of the commercial testing laboratory or Contractor's testing facilities.

### 1.4 SUBSURFACE DATA

Subsurface soil boring logs are shown on the drawings and in Attachment A at the end of this section. These data represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

### 1.5 CLASSIFICATION OF EXCAVATION

Excavation specified shall be done on a classified basis, in accordance with the following designations and classifications.

#### 1.5.1 Rock Excavation

Rock excavation shall include excavating, grading, and disposing of material classified as rock and shall include the satisfactory removal and disposal of boulders 1/2 cubic meter or more in volume; solid rock; rock material that is in ledges, bedded deposits, and unstratified masses, which cannot be removed without systematic drilling; and firmly cemented conglomerate deposits possessing the characteristics of solid rock impossible to remove without systematic drilling. The removal of any concrete or masonry structures, except pavements, exceeding 1/2 cubic meter in volume that may be encountered in the work shall be included in this classification. If at any time during excavation, including excavation from borrow areas, the Contractor encounters material that may be classified as rock excavation, such material shall be uncovered and the Contracting Officer notified by the Contractor. The Contractor shall not proceed with the excavation of this material until the Contracting Officer has classified the materials as common excavation or rock excavation and has taken cross sections as required. Failure on the part of the Contractor to uncover such material, notify the Contracting Officer, and allow ample time for classification and cross sectioning of the undisturbed surface of such material will cause the forfeiture of the Contractor's right of claim to any classification or volume of material to be paid for other than that allowed by the Contracting Officer for the areas of work in which such deposits occur.

#### 1.5.2 Common Excavation

Common excavation shall include the satisfactory removal and disposal of all materials not classified as rock excavation.

#### 1.6 UTILIZATION OF EXCAVATED MATERIALS

Unsatisfactory materials removed from excavations shall be disposed of in designated waste disposal or spoil areas. Satisfactory material removed from excavations shall be used, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. No satisfactory excavated material shall be wasted without specific written authorization. Satisfactory material authorized to be wasted shall be disposed of in designated areas approved for surplus material storage or designated waste areas as directed. Newly designated waste areas on Government-controlled land shall be cleared and grubbed before disposal of waste material thereon. Coarse rock from excavations shall be stockpiled and used for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. No excavated material shall be disposed of to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

### 3.1 STRIPPING OF TOPSOIL

Where indicated or directed, topsoil shall be stripped to a depth of 75 millimeters. Topsoil shall be spread on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Topsoil shall be kept separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 50 mm in diameter, and other materials that would interfere with planting and maintenance operations. Any surplus of topsoil from excavations and grading shall be removed from the site.

### 3.2 GENERAL EXCAVATION

The Contractor shall perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Grading shall be in conformity with the typical sections shown and the tolerances specified in paragraph FINISHING. Satisfactory excavated materials shall be transported to and placed in fill or embankment within the limits of the work. Unsatisfactory materials encountered within the limits of the work shall be excavated below grade and replaced with satisfactory materials as directed. Such excavated material and the satisfactory material ordered as replacement shall be included in excavation. Surplus satisfactory excavated material not required for fill or embankment shall be disposed of in areas approved for surplus material storage or designated waste areas. Unsatisfactory excavated material shall be disposed of in designated waste or spoil areas. During construction, excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. Material required for fill or embankment in excess of that produced by excavation within the grading limits shall be excavated from the borrow areas indicated or from other approved areas selected by the Contractor as specified.

#### 3.2.1 Ditches, Gutters, and Channel Changes

Excavation of ditches, gutters, and channel changes shall be accomplished by cutting accurately to the cross sections, grades, and elevations shown. Ditches and gutters shall not be excavated below grades shown. Excessive open ditch or gutter excavation shall be backfilled with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Material excavated shall be disposed of as shown or as directed, except that in no case shall material be deposited less than 1 meter from the edge of a ditch. The Contractor shall maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

#### 3.2.2 Drainage Structures

Excavations shall be made to the lines, grades, and elevations shown, or as directed. Trenches and foundation pits shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock or other hard foundation material shall be cleaned of loose debris and cut to a firm, level, stepped,

or serrated surface. Loose disintegrated rock and thin strata shall be removed. When concrete or masonry is to be placed in an excavated area, the bottom of the excavation shall not be disturbed. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed. Where pile foundations are to be used, the excavation of each pit shall be stopped at an elevation 300 mm above the base of the footing, as specified, before piles are driven. After the pile driving has been completed, loose and displaced material shall be removed and excavation completed, leaving a smooth, solid, undisturbed surface to receive the concrete or masonry.

### 3.3 SELECTION OF BORROW MATERIAL

Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas within the limits of the project site, selected by the Contractor or from approved private sources. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.

### 3.4 OPENING AND DRAINAGE OF EXCAVATION AND BORROW PITS

The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

### 3.5 GRADING AREAS

Where indicated, work will be divided into grading areas within which satisfactory excavated material shall be placed in embankments, fills, and required backfills. The Contractor shall not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing.

### 3.6 BACKFILL

Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure. Ground surface on which backfill is to be placed shall be prepared as specified in paragraph PREPARATION OF GROUND SURFACE FOR EMBANKMENTS. Compaction requirements for backfill materials shall also conform to the applicable portions of paragraphs PREPARATION OF GROUND SURFACE FOR EMBANKMENTS, EMBANKMENTS, and SUBGRADE PREPARATION, and Section 02630 STORM-DRAINAGE SYSTEM; and Section 02316 EXCAVATION, TRENCHING, AND

BACKFILLING FOR UTILITIES SYSTEMS. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

### 3.7 PREPARATION OF GROUND SURFACE FOR EMBANKMENTS

#### 3.7.1 General Requirements

Ground surface on which fill is to be placed shall be stripped of live, dead, or decayed vegetation, rubbish, debris, and other unsatisfactory material; plowed, disked, or otherwise broken up to a depth of 150 mm; pulverized; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. The prepared ground surface shall be scarified and moistened or aerated as required just prior to placement of embankment materials to assure adequate bond between embankment material and the prepared ground surface.

#### 3.7.2 Frozen Material

Embankment shall not be placed on a foundation which contains frozen material, or which has been subjected to freeze-thaw action. This prohibition encompasses all foundation types, including the natural ground, all prepared subgrades (whether in an excavation or on an embankment) and all layers of previously placed and compacted earth fill which become the foundations for successive layers of earth fill. All material that freezes or has been subjected to freeze-thaw action during the construction work, or during periods of temporary shutdowns, such as, but not limited to, nights, holidays, weekends, winter shutdowns, or earthwork operations, shall be removed to a depth that is acceptable to the Contracting Officer and replaced with new material. Alternatively, the material will be thawed, dried, reworked, and recompact to the specified criteria before additional material is placed. The Contracting Officer will determine when placement of fill shall cease due to cold weather. The Contracting Officer may elect to use average daily air temperatures, and/or physical observation of the soils for his determination. Embankment material shall not contain frozen clumps of soil, snow, or ice.

### 3.8 EMBANKMENTS

#### 3.8.1 Earth Embankments

Earth embankments shall be constructed from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 75 mm.

The material shall be placed in successive horizontal layers of loose material not more than 300 millimeters in depth. Each layer shall be spread uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, each layer shall be plowed, disked, or otherwise broken up; moistened or aerated as necessary; thoroughly mixed; and compacted to at least 90 percent laboratory maximum



density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Compaction requirements for the upper portion of earth embankments forming subgrade for pavements shall be identical with those requirements specified in paragraph SUBGRADE PREPARATION. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

### 3.9 SUBGRADE PREPARATION

#### 3.9.1 Construction

Subgrade shall be shaped to line, grade, and cross section, and compacted as specified. This operation shall include plowing, disking, and any moistening or aerating required to obtain specified compaction. Soft or otherwise unsatisfactory material shall be removed and replaced with satisfactory excavated material or other approved material as directed. Rock encountered in the cut section shall be excavated to a depth of 150 mm below finished grade for the subgrade. Low areas resulting from removal of unsatisfactory material or excavation of rock shall be brought up to required grade with satisfactory materials, and the entire subgrade shall be shaped to line, grade, and cross section and compacted as specified. After rolling, the surface of the subgrade for roadways shall not show deviations greater than 12.7 millimeter when tested with a 3.05 meter straightedge applied both parallel and at right angles to the centerline of the area. The elevation of the finish subgrade shall not vary more than 15 mm from the established grade and cross section.

#### 3.9.2 Compaction

Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Except for paved areas and railroads, each layer of the embankment shall be compacted to at least 90 percent of laboratory maximum density.

##### 3.9.2.1 Subgrade for Pavements

Subgrade for pavements shall be compacted to at least 95 percentage laboratory maximum density for the depth below the surface of the pavement shown. When more than one soil classification is present in the subgrade, the top 150 mm of subgrade shall be scarified, windrowed, thoroughly blended, reshaped, and compacted.

##### 3.9.2.2 Subgrade for Shoulders

Subgrade for shoulders shall be compacted to at least 95 percentage laboratory maximum density for the depth below the surface of shoulder shown.

### 3.10 SHOULDER CONSTRUCTION

Shoulders shall be constructed of satisfactory excavated or borrow material or as otherwise shown or specified. Shoulders shall be constructed as soon as possible after adjacent paving is complete, but in the case of rigid pavements, shoulders shall not be constructed until permission of the

Contracting Officer has been obtained. The entire shoulder area shall be compacted to at least the percentage of maximum density as specified in paragraph SUBGRADE PREPARATION above, for specific ranges of depth below the surface of the shoulder. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Shoulder construction shall be done in proper sequence in such a manner that adjacent ditches will be drained effectively and that no damage of any kind is done to the adjacent completed pavement. The completed shoulders shall be true to alignment and grade and shaped to drain in conformity with the cross section shown.

### 3.11 FINISHING

The surface of excavations, embankments, and subgrades shall be finished to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. The degree of finish for graded areas shall be within 30 mm of the grades and elevations indicated except that the degree of finish for subgrades shall be specified in paragraph SUBGRADE PREPARATION. Gutters and ditches shall be finished in a manner that will result in effective drainage. The surface of areas to be turfed shall be finished to a smoothness suitable for the application of turfing materials.

### 3.12 PLACING TOPSOIL

On areas to receive topsoil, the compacted subgrade soil shall be scarified to a 50 mm depth for bonding of topsoil with subsoil. Topsoil then shall be spread evenly to a thickness of 150 mm and graded to the elevations and slopes shown. Topsoil shall not be spread when frozen or excessively wet or dry. Material required for topsoil in excess of that produced by excavation within the grading limits shall be obtained from offsite areas.

### 3.13 TESTING

Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. If the Contractor elects to establish testing facilities, no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved by the Contracting Officer. Field in-place density shall be determined in accordance with ASTM D 1556 ASTM D 2167 ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using only the sand cone method as described in ASTM D 1556. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017; the calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. ASTM D 2937, Drive Cylinder Method shall be used only for soft, fine-grained, cohesive soils. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, the material shall be removed, replaced and recompact to meet specification requirements. Tests on recompact areas shall be performed to determine conformance with specification requirements. Inspections and test results shall be certified by a registered professional

civil engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

#### 3.13.1 Fill and Backfill Material Gradation

One test per \_\_\_\_\_ cubic meters stockpiled or in-place source material. Gradation of fill and backfill material shall be determined in accordance with ASTM C 136 ASTM D 422 ASTM D 1140.

#### 3.13.2 In-Place Densities

- a. One test per \_\_\_\_\_ square meters, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.
- b. One test per \_\_\_\_\_ square meters, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.
- c. One test per \_\_\_\_\_ linear meters, or fraction thereof, of each lift of embankment or backfill for roads airfields.
- d. One test per \_\_\_\_\_ linear meters, or fraction thereof, of each lift of embankment or backfill for railroads.

#### 3.13.3 Check Tests on In-Place Densities

If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 as follows:

- a. One check test per lift for each \_\_\_\_\_ square meters, or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines.
- b. One check test per lift for each \_\_\_\_\_ square meters, of fill or backfill areas compacted by hand-operated machines.
- c. One check test per lift for each \_\_\_\_\_ linear meters, or fraction thereof, of embankment or backfill for roads airfields.
- d. One check test per lift for each \_\_\_\_\_ linear meters, or fraction thereof, of embankment or backfill for railroads.

#### 3.13.4 Moisture Contents

In the stockpile, excavation, or borrow areas, a minimum of two tests per day per type of material or source of material being placed during stable weather conditions shall be performed. During unstable weather, tests shall be made as dictated by local conditions and approved by the Contracting Officer.

### 3.13.5 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per \_\_\_\_\_ cubic meters of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

### 3.13.6 Tolerance Tests for Subgrades

Continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION shall be made during construction of the subgrades.

### 3.14 SUBGRADE AND EMBANKMENT PROTECTION

During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along subgrade shall be maintained to drain effectively at all times. The finished subgrade shall not be disturbed by traffic or other operation and shall be protected and maintained by the Contractor in a satisfactory condition until ballast, subbase, base, or pavement is placed. The storage or stockpiling of materials on the finished subgrade will not be permitted. No subbase, base course, ballast, or pavement shall be laid until the subgrade has been checked and approved, and in no case shall subbase, base, surfacing, pavement, or ballast be placed on a muddy, spongy, or frozen subgrade.

-- End of Section --

# GRAPHIC BORING LOG

**A-01-1**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams

DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION:

ELEVATION DATUM: NGVD

DATE: 3-26-01

GROUNDWATER ENTRY:

DELAYED GROUNDWATER:

NORTH: 211493.6

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 532999.2

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_w$ (pcf)	PP (KSF)				
0									Stiff, dry, dark brownish gray, Silty LEAN CLAY (CL) (topsoil)			
									Stiff, dry to damp, reddish brown, Silty LEAN CLAY (CL) with cherty gravel		2	
5									Stiff, damp, red, FAT CLAY (CH)		5	
									No Refusal		6.5	
									<b>BOTTOM OF BORING A-01-1 AT 6.5 FEET</b>			
10												
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-2**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION: ELEVATION DATUM: NGVD

DATE: 3-26-01

GROUNDWATER ENTRY: DELAYED GROUNDWATER:

NORTH: 211503.7

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533010.3

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_w$ (pcf)	PP (KSF)	$Q_u$ (ksf)			
0												
									Stiff, dry, dark gray brown, Silty LEAN CLAY (CL) (topsoil)			
											2	
									Stiff, dry to damp, reddish brown, LEAN CLAY (CL) with cherty gravel			
5												
											7	
									Stiff, damp, red. FAT CLAY (CH)			
									No Refusal		8	
									BOTTOM OF BORING A-01-2 AT 8.0 FEET			
10												
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-3**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks  
 PROJECT LOCATION: Fort Leonard Wood, Missouri  
 LOGGED BY: B. Adams DRILLING CO: Corps of Engineers  
 SURFACE ELEVATION: ELEVATION DATUM: NGVD  
 GROUNDWATER ENTRY: DELAYED GROUNDWATER:  
 OBSERVATIONS: Groundwater not detected at time of drilling

SHEET 1 OF 1  
 PROJECT NO:  
 RIG: CME-750  
 DATE: 3-26-01  
 NORTH: 211513.8  
 EAST: 533021.4

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	ROD LENGTH	ROD/REC (%)	RESISTANCE/COMPONENTS	WATER (%)	$\gamma_d$ (pcf)	PP (KSF)	$Q_u$ (ksf)			
0												
									Stiff, dry, dark gray brown, Silty LEAN CLAY (CL) (topsoil)			
											2	
									Stiff, dry to damp, reddish brown, LEAN CLAY (CL) with cherty gravel			
5												
											7	
									Stiff, damp, red. FAT CLAY (CH)			
10									No refusal		10	
									BOTTOM OF BORING A-01-3 AT 10.0 FEET			
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-4**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams

DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION:

ELEVATION DATUM: NGVD

DATE: 3-26-01

GROUNDWATER ENTRY:

DELAYED GROUNDWATER:

NORTH: 211524.5

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533031.9

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	ROD LENGTH	ROD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_d$ (pcf)	PP (KSF)	$Q_u$ (ksf)			
0												
									Stiff, dry, dark gray brown, Silty LEAN CLAY (CL) (topsoil)			
									Stiff, dry to damp, reddish brown, LEAN CLAY (CL) with cherty gravel			
5									Hard from 4' to 4.5'			
									Stiff, damp, red, FAT CLAY (CH)			
10									No refusal			
									BOTTOM OF BORING A-01-4 AT 10.0 FEET			
15												
20												
25												



# GRAPHIC BORING LOG

**A-01-5**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION: ELEVATION DATUM: NGVD

DATE: 3-26-01

GROUNDWATER ENTRY: DELAYED GROUNDWATER:

NORTH: 211534.3

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533043.3

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_s$ (pcf)	PP (KSF)				
0									Stiff, dry, dark gray brown, Silty LEAN CLAY (CL) (topsoil)			
2.5									Stiff, dry to damp reddish brown. LEAN CLAY (CL) with cherty gravel			
6.5									Stiff, damp, red. FAT CLAY (CH)			
11.5									No refusal			
									BOTTOM OF BORING A-01-5 AT 11.5 FEET			
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-6**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION: ELEVATION DATUM: NGVD

DATE: 3-27-01

GROUNDWATER ENTRY: DELAYED GROUNDWATER:

NORTH: 211545.2

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533053.6

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_w$ (pcf)	PP (KSF)				
0									Stiff, dry, dark gray brown, Silty LEAN CLAY (CL) (topsoil)			
2									Stiff, dry to damp, reddish brown LEAN CLAY (CL) with cherty gravel			
5												
8									Stiff, damp, red, FAT CLAY (CH)			
10												
13									No refusal			
									BOTTOM OF BORING A-01-6 AT 13.0 FEET			
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-7**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION: ELEVATION DATUM: NGVD

DATE: 3-27-01

GROUNDWATER ENTRY: DELAYED GROUNDWATER:

NORTH: 211555.1

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533064.9

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_d$ (pcf)	PP (KSF)				
0									Stiff, dry, dark gray brown, Silty LEAN CLAY (CL) (topsoil)			
									Stiff, dry to damp, reddish brown, Gravelly LEAN CLAY (CL)		2	
									Stiff, damp, red, FAT CLAY (CH)		4	
5												
10												
									No refusal		13	
									BOTTOM OF BORING A-01-7 AT 13.0 FEET			
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-8**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams

DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION:

ELEVATION DATUM: NGVD

DATE: 3-27-01

GROUNDWATER ENTRY:

DELAYED GROUNDWATER:

NORTH: 211565.6

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533075.5

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	ROD LENGTH	ROD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_d$ (pcf)	PP (ksf)				
0									Stiff, dry, dark gray brown, Silty LEAN CLAY (CL) (topsoil)	1		
									Stiff, dry to damp, reddish brown, Silty LEAN CLAY (CL) with gravel			
									Hard from 3' to 4'			
5												
									Stiff, damp, red, FAT CLAY (CI)	7		
10												
									No refusal	13		
									BOTTOM OF BORING A-01-8 AT 13.0 FEET			
15												
20												
25												

# GRAPHIC BORING LOG

## A-01-9

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams

DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION:

ELEVATION DATUM: NGVD

DATE: 3-27-01

GROUNDWATER ENTRY:

DELAYED GROUNDWATER:

NORTH: 211575.1

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533087.1

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	ROD LENGTH	ROD/REC (%)	RESISTANCE/COMPONENTS	WATER (%)	$\gamma_d$ (pcf)	PP (KSF)	$Q_u$ (ksf)			
0												
									Stiff, dry, dark brown gray, Silty LEAN CLAY (CL) (topsoil)			
									Stiff, dry to damp, reddish brown, LEAN CLAY (CL) with cherty gravel		2	
5									Gravelly from 4' to 5'			
									Stiff, damp, red, FAT CLAY (CH)		6	
10												
									No refusal		13	
									BOTTOM OF BORING A-01-9 AT 13.0 FEET			
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-10**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION: ELEVATION DATUM: NGVD

DATE: 3-27-01

GROUNDWATER ENTRY: DELAYED GROUNDWATER:

NORTH: 211585.8

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533097.7

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	ROD LENGTH	ROD REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_w$ (pcf)	PP (KSF)				
0									Stiff, dry, dark gray brown, Silty LEAN CLAY (CL) (topsoil)			
									Stiff, damp, reddish brown, LEAN CLAY (CL) with cherry gravel			
5									Stiff, damp, red, FAT CLAY (CH)			
10									No refusal			
									<b>BOTTOM OF BORING A-01-10 AT 11.5 FEET</b>			
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-11**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams

DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION:

ELEVATION DATUM: NGVD

DATE: 3-27-01

GROUNDWATER ENTRY:

DELAYED GROUNDWATER:

NORTH: 211596.4

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533108.3

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE COMPONENTS	WATER (%)	$\gamma_d$ (pcf)	PP (KSF)				
0									Stiff, damp, dark gray brown, Silty LEAN CLAY (CL) (topsoil)			
									Stiff, damp, dark gray brown, Silty LEAN CLAY (CL)			
5									Stiff, damp, reddish brown, Gravelly LEAN CLAY (CL)			
									Stiff, damp, red, FAT CLAY (CH)			
10									No refusal			
									BOTTOM OF BORING A-01-11 AT 11.5 FEET			
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-12**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams

DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION:

ELEVATION DATUM: NGVD

DATE: 3-27-01

GROUNDWATER ENTRY:

DELAYED GROUNDWATER:

NORTH: 211605.9

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533119.9

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_d$ (pcf)	PP (KSF)	$Q_u$ (ksf)			
0												
									Stiff, damp, dark gray brown, Silty LEAN CLAY (CL) (topsoil)			
											2	
									Stiff, damp, reddish brown, LEAN CLAY (CL)			
5												
											8	
									Stiff, damp, red. FAT CLAY (CH)			
10												
									No refusal		11.5	
									BOTTOM OF BORING A-01-12 AT 11.5 FEET			
15												
20												
25												





# GRAPHIC BORING LOG

**A-01-14**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks  
 PROJECT LOCATION: Fort Leonard Wood, Missouri  
 LOGGED BY: B. Adams DRILLING CO: Corps of Engineers  
 SURFACE ELEVATION: ELEVATION DATUM: NGVD  
 GROUNDWATER ENTRY: DELAYED GROUNDWATER:  
 OBSERVATIONS: Groundwater not detected at time of drilling

SHEET 1 OF 1  
 PROJECT NO:  
 RIG: CME-750  
 DATE: 3-27-01  
 NORTH: 211627.3  
 EAST: 533141

DEPTH (feet)	SAMPLE DATA							DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	ROD LENGTH	ROD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_a$ (pcf)				
0								Stiff, damp, dark brown gray, Silty LEAN CLAY (CL) (topsoil)			
2								Stiff, damp, brown, Silty LEAN CLAY (CL) with gravel			
5								Stiff, damp, red, LEAN CLAY (CL)			
8								Stiff, damp, red, FAT CLAY (CH)			
10								No refusal			
11.5								BOTTOM OF BORING A-01-14 AT 11.5 FEET			
15											
20											
25											

# GRAPHIC BORING LOG

## A-01-15

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION: ELEVATION DATUM: NGVD

DATE: 3-27-01

GROUNDWATER ENTRY: DELAYED GROUNDWATER:

NORTH: 211637.2

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533152.2

DEPTH (feet)	SAMPLE DATA							DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	ROD LENGTH	ROD REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_w$ (pcf)	PP (KSF)	$Q_u$ (ksf)		
0											
								Stiff, damp, dark gray brown, Silty LEAN CLAY (CL) (topsoil)			
								Stiff, damp, reddish brown, LEAN CLAY (CL) with cherty gravel			
5								Stiff, damp, red. FAT CLAY (CH)			
								Hard and gravelly from 8' to 9'			
10								No refusal			
								BOTTOM OF BORING A-01-15 AT 10.0 FEET			
15											
20											
25											

# GRAPHIC BORING LOG

**A-01-16**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams

DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION:

ELEVATION DATUM: NGVD

DATE: 3-27-01

GROUNDWATER ENTRY:

DELAYED GROUNDWATER:

NORTH: 211647.2

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533163.4

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_d$ (pcf)	PP (KSF)				
0									Hard, damp, black to gray, GRAVEL (GP) (fill)			
1.5									Stiff, damp, reddish brown, Gravelly LEAN CLAY (CL)			
5												
7									Stiff, damp, red, FAT CLAY (CH)			
8									No refusal			
									BOTTOM OF BORING A-01-16 AT 8.0 FEET			
10												
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-17**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams

DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION:

ELEVATION DATUM: NGVD

DATE: 3-27-01

GROUNDWATER ENTRY:

DELAYED GROUNDWATER:

NORTH: 211657.8

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533174

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_d$ (pcf)	PP (KSF)				
0									Stiff, damp, dark gray brown, Silty LEAN CLAY (CL) (topsoil)			
2									Stiff, damp, reddish brown, LEAN CLAY (CL) with cherry gravel			
5									Stiff, damp, red, FAT CLAY (CH)			
8									No refusal			
10									BOTTOM OF BORING A-01-17 AT 8.0 FEET			
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-18**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams

DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION:

ELEVATION DATUM: NGVD

DATE: 3-27-01

GROUNDWATER ENTRY:

DELAYED GROUNDWATER:

NORTH: 211668

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533185

DEPTH (feet)	SAMPLE DATA							DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE COMPONENTS	WATER (%)	$\gamma_w$ (pcf)				
0								Stiff, damp, dark gray brown, Silty LEAN CLAY (CL) (topsoil)			
2								Stiff, damp, reddish brown, LEAN CLAY (CL) with cherty gravel Hard at 3' to 5'			
5								Stiff, damp, red, FAT CLAY (CH)			
10								No refusal BOTTOM OF BORING A-01-18 AT 10.0 FEET			
15											
20											
25											

**A-01-19**

**PROJECT NAME:** Fort Leonard Wood FY01 BCT Barracks

**SHEET**      **1**      **OF**      **1**

**PROJECT LOCATION:** Fort Leonard Wood, Missouri

**PROJECT NO:**

LOGGED BY: B. Adams DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION: \_\_\_\_\_ ELEVATION DATUM: \_\_\_\_\_ NGVD

DATE: 3-27-01

**GROUNDWATER ENTRY:**                      **DELAYED GROUNDWATER:**

NORTH: 211678.1

**OBSERVATIONS:** Groundwater not detected at time of drilling

**EAST:** 533196.1

[illegible]





# GRAPHIC BORING LOG

**A-01-21**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION: ELEVATION DATUM: NGVD

DATE: 3-27-01

GROUNDWATER ENTRY: DELAYED GROUNDWATER:

NORTH: 211707.6

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533190.6

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE/COMPONENTS	WATER (%)	$\gamma_w$ (pcf)	PP (KSF)				
0									Stiff, damp, dark brownish black, Silty LEAN CLAY (CL) (topsoil)			
									Stiff, damp, red, FAT CLAY (CH)		1.5	
5									No refusal		5	
									BOTTOM OF BORING A-01-21 AT 5.0 FEET			
10												
15												
20												
25												

**A-01-22**

**PROJECT NAME:** Fort Leonard Wood FY01 BCT Barracks

**SHEET 1 OF 1**

**PROJECT LOCATION:** Fort Leonard Wood, Missouri

**PROJECT NO:**

LOGGED BY: B. Adams DRILLING CO: Corps of Engineers

RIG: CME-750

**SURFACE ELEVATION:** \_\_\_\_\_ **ELEVATION DATUM:** \_\_\_\_\_ **NGVD**

DATE: 3-27-01

GROUNDWATER ENTRY: \_\_\_\_\_ DELAYED GROUNDWATER: \_\_\_\_\_

**NORTH:** 211722.3

**OBSERVATIONS:** Groundwater not detected at time of drilling

EAST: 533187.4

[illegible]

# GRAPHIC BORING LOG

**A-01-23**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks  
 PROJECT LOCATION: Fort Leonard Wood, Missouri  
 LOGGED BY: B. Adams DRILLING CO: Corps of Engineers  
 SURFACE ELEVATION: ELEVATION DATUM: NGVD  
 GROUNDWATER ENTRY: DELAYED GROUNDWATER:  
 OBSERVATIONS: Groundwater not detected at time of drilling

SHEET 1 OF 1  
 PROJECT NO:  
 RIG: CME-750  
 DATE: 3-27-01  
 NORTH: 211734.9  
 EAST: 533181.1

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	ROD LENGTH	ROD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_d$ (pcf)	PP (KSF)				
0									Stiff, damp, dark gray brown, Silty LEAN CLAY (CL) (topsoil)			
4									Stiff, damp, red, FAT CLAY (CH) with cherty gravel			
8									No refusal			
8.0									BOTTOM OF BORING A-01-23 AT 8.0 FEET			
10												
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-24**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION: ELEVATION DATUM: NGVD

DATE: 3-27-01

GROUNDWATER ENTRY: DELAYED GROUNDWATER:

NORTH: 211745

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533170

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_s$ (pcf)	PP (KSF)				
0									Stiff, damp, brownish gray, Silty LEAN CLAY (CL) (topsoil) with gravel			
4									Stiff, damp, red, FAT CLAY (CH)			
6.5									No refusal			
									BOTTOM OF BORING A-01-24 AT 6.5 FEET			
10												
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-25**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION: ELEVATION DATUM: NGVD

DATE: 3-27-01

GROUNDWATER ENTRY: DELAYED GROUNDWATER:

NORTH: 211755.1

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533158.9

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_d$ (pcf)	PP (KSF)	$Q_u$ (ksf)			
0												
									Stiff, damp, dark gray brown, Silty LEAN CLAY (CL) (topsoil)			
									Stiff, damp, reddish brown, LEAN CLAY (CL) with gravel			
5									Stiff, damp, red, FAT CLAY (CH)			
									No refusal			
									BOTTOM OF BORING A-01-25 AT 8.0 FEET			
10												
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-26**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks  
 PROJECT LOCATION: Fort Leonard Wood, Missouri  
 LOGGED BY: B. Adams DRILLING CO: Corps of Engineers  
 SURFACE ELEVATION: ELEVATION DATUM: NGVD  
 GROUNDWATER ENTRY: DELAYED GROUNDWATER:  
 OBSERVATIONS: Groundwater not detected at time of drilling

SHEET 1 OF 1  
 PROJECT NO:  
 RIG: CME-750  
 DATE: 3-27-01  
 NORTH: 211765.2  
 EAST: 533147.8

DEPTH (feet)	SAMPLE DATA							DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_d$ (pcf)	PP (KSF)	$Q_u$ (ksf)		
0											
								Asphalt			
								Stiff, damp, dark gray brown, Silty LEAN CLAY (CL) with gravel			
								Stiff, damp, reddish brown, Gravelly LEAN CLAY (CL)			
5								Hard from 4' to 7'			
								No refusal			
								BOTTOM OF BORING A-01-26 AT 8.0 FEET			
10											
15											
20											
25											

# GRAPHIC BORING LOG

**A-01-27**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams

DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION:

ELEVATION DATUM: NGVD

DATE: 3-27-01

GROUNDWATER ENTRY:

DELAYED GROUNDWATER:

NORTH: 211775.3

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533136.7

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE COMPONENTS	WATER (%)	$\gamma_w$ (pcf)	PP (KSF)				
0									Hard, damp, dark gray to black, Silty LEAN CLAY (CL) with gravel (road grade with asphalt)			
									Stiff, damp, reddish brown, Gravelly LEAN CLAY (CL)		3	
5									Stiff, damp, red. FAT CLAY (CH)		6	
									Gravelly from 6' to 8'			
									No refusal		8	
									BOTTOM OF BORING A-01-27 AT 8.0 FEET			
10												
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-28**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams

DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION:

ELEVATION DATUM: NGVD

DATE: 3-27-01

GROUNDWATER ENTRY:

DELAYED GROUNDWATER:

NORTH: 211785.4

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533125.6

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE COMPONENTS	WATER (%)	$w_L$ (pct)	PP (KSF)				
0									Hard, damp, black to dark gray brown, Silty LEAN CLAY (CL) with gravel (road grade and asphalt)			
3.5									Stiff, damp, reddish brown, Gravelly LEAN CLAY (CL)			
6									Stiff, damp, red, FAT CLAY (CH)			
8									No refusal			
									BOTTOM OF BORING A-01-28 AT 8.0 FEET			
10												
15												
20												
25												



# GRAPHIC BORING LOG

**A-01-29**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks  
 PROJECT LOCATION: Fort Leonard Wood, Missouri  
 LOGGED BY: B. Adams DRILLING CO: Corps of Engineers  
 SURFACE ELEVATION: ELEVATION DATUM: NGVD  
 GROUNDWATER ENTRY: DELAYED GROUNDWATER:  
 OBSERVATIONS: Groundwater not detected at time of drilling

SHEET 1 OF 1  
 PROJECT NO:  
 RIG: CME-750  
 DATE: 3-27-01  
 NORTH: 211798.2  
 EAST: 533120.4

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_w$ (pcf)	PP (KSF)				
0									Hard, damp, black to dark gray brown, Silty GRAVEL (GP) (roadgrade with asphalt)			
3									Stiff, damp, reddish brown, Gravelly LEAN CLAY (CL)		3	
5									Stiff, damp, red, FAT CLAY (CH)		5	
10									Hard sandstone layer at 9' to 9.5' No refusal		10	
									BOTTOM OF BORING A-01-29 AT 10.0 FEET			
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-30**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION: ELEVATION DATUM: NGVD

DATE: 3-27-01

GROUNDWATER ENTRY: DELAYED GROUNDWATER:

NORTH: 211813.1

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533121.1

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_w$ (pcf)	PP (KSF)				
0									Stiff, damp, dark gray brown, Silty LEAN CLAY (CL) (topsoil) with gravel Stiff, damp, red, Gravolly FAT CLAY (CH)	1		
5									Hard at 6'			
10									Hard at 12' No refusal	13		
									BOTTOM OF BORING A-01-30 AT 13.0 FEET			
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-31**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks SHEET 1 OF 1  
 PROJECT LOCATION: Fort Leonard Wood, Missouri PROJECT NO:  
 LOGGED BY: B. Adams DRILLING CO: Corps of Engineers RIG: CME-750  
 SURFACE ELEVATION: ELEVATION DATUM: NGVD DATE: 3-28-01  
 GROUNDWATER ENTRY: DELAYED GROUNDWATER: NORTH: 211828.1  
 OBSERVATIONS: Groundwater not detected at time of drilling EAST: 533121.1

DEPTH (feet)	SAMPLE DATA							DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_w$ (pcf)				
0								Stiff, damp, dark gray brown, Silty LEAN CLAY (CL) (topsoil)			
								Stiff, damp, red, Gravelly FAT CLAY (CH)			
5											
10											
								No refusal		13	
								BOTTOM OF BORING A-01-31 AT 13.0 FEET			
15											
20											
25											

# GRAPHIC BORING LOG

**A-01-32**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks  
 PROJECT LOCATION: Fort Leonard Wood, Missouri  
 LOGGED BY: B. Adams DRILLING CO: Corps of Engineers  
 SURFACE ELEVATION: ELEVATION DATUM: NGVD  
 GROUNDWATER ENTRY: DELAYED GROUNDWATER:  
 OBSERVATIONS: Groundwater not detected at time of drilling

SHEET 1 OF 1  
 PROJECT NO:  
 RIG: CME-750  
 DATE: 3-28-01  
 NORTH: 211840.1  
 EAST: 533112

DEPTH (feet)	SAMPLE DATA							DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	ROD LENGTH	ROD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_a$ (pcf)	PP (KSF)	$C_u$ (ksf)		
0											
								Stiff, damp, dark gray brown, Silty LEAN CLAY (Cl.) (topsoil)			
								Stiff, damp, red, Gravelly FAT CLAY (CH)			
5											
10											
								No refusal		13	
								BOTTOM OF BORING A-01-32 AT 13.0 FEET			
15											
20											
25											

# GRAPHIC BORING LOG

**A-01-33**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION: ELEVATION DATUM: NGVD

DATE: 3-28-01

GROUNDWATER ENTRY: DELAYED GROUNDWATER:

NORTH: 211852

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533102.9

DEPTH (feet)	SAMPLE DATA							DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	ROD LENGTH	ROD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_w$ (pcf)				
0								Stiff, damp, red, Silty LEAN CLAY (CL) (topsoil) with gravel			
								Stiff, damp, red, Gravelly FAT CLAY (CH)			
5											
10											
13								No refusal			
								BOTTOM OF BORING A-01-33 AT 13.0 FEET			
15											
20											
25											

# GRAPHIC BORING LOG

**A-01-34**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks  
 PROJECT LOCATION: Fort Leonard Wood, Missouri  
 LOGGED BY: B. Adams DRILLING CO: Corps of Engineers  
 SURFACE ELEVATION: ELEVATION DATUM: NGVD  
 GROUNDWATER ENTRY: DELAYED GROUNDWATER:  
 OBSERVATIONS: Groundwater not detected at time of drilling

SHEET 1 OF 1  
 PROJECT NO:  
 RIG: CME-750  
 DATE: 3-28-01  
 NORTH: 211863.9  
 EAST: 533093.8

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	ROD LENGTH	ROD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_w$ (pcf)	PP (KSF)	$Q_u$ (ksf)			
0												
									Stiff, damp, dark gray brown, Silty LEAN CLAY (CL) (topsoil)			
											2	
									Stiff, damp, reddish brown, Gravelly LEAN CLAY (CL)			
5											5	
									Stiff, damp, red, FAT CLAY (CH)			
									Hard at 8.5'			
10									No refusal		10	
									BOTTOM OF BORING A-01-34 AT 10.0 FEET			
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-35**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams

DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION:

ELEVATION DATUM: NGVD

DATE: 3-28-01

GROUNDWATER ENTRY:

DELAYED GROUNDWATER:

NORTH: 211875.8

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533084.7

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REG (%)	RESISTANCE COMPONENTS	WATER (%)	$\gamma_w$ (pcf)	PP (KSF)	$Q_u$ (ksf)			
0												
									Stiff, damp, dark gray brown, Silty LEAN CLAY (CL) (topsoil)			
											2	
									Stiff, damp, reddish brown, Gravelly LEAN CLAY (CL)			
											4	
5									Stiff, damp, red, FAT CLAY (CH)			
									Hard at 6.5' to 7'			
									No refusal		8	
									BOTTOM OF BORING A-01-35 AT 8.0 FEET			
10												
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-36**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams

DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION:

ELEVATION DATUM: NGVD

DATE: 3-28-01

GROUNDWATER ENTRY:

DELAYED GROUNDWATER:

NORTH: 211887.7

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533075.6

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE COMPONENTS	WATER (%)	$\gamma_w$ (pcf)	PP (KSF)	$Q_u$ (ksf)			
0												
										Stiff, damp, dark gray brown, Silty LEAN CLAY (CL) (topsoil)		
											2	
										Stiff, damp, reddish brown, Gravelly LEAN CLAY (CL)		
											4	
5										Stiff, damp, red, FAT CLAY (CH)		
										Hard at 6.5' to 7'		
										No refusal	8	
										BOTTOM OF BORING A-01-36 AT 8.0 FEET		
10												
15												
20												
25												



# GRAPHIC BORING LOG

**A-01-37**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION: ELEVATION DATUM: NGVD

DATE: 3-28-01

GROUNDWATER ENTRY: DELAYED GROUNDWATER:

NORTH: 211899.6

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533066.5

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REG (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_d$ (pcf)	PP (KSF)				
0									Stiff, damp, dark gray, Silty LEAN CLAY (CL) (topsoil)			
									Stiff, damp, reddish brown, Silty LEAN CLAY (CL) with gravel		2	
									Stiff, damp, red, FAT CLAY (CH)		4	
5									No refusal		6.5	
									BOTTOM OF BORING A-01-37 AT 6.5 FEET			
10												
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-37**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks  
 PROJECT LOCATION: Fort Leonard Wood, Missouri  
 LOGGED BY: B. Adams DRILLING CO: Corps of Engineers  
 SURFACE ELEVATION: ELEVATION DATUM: NGVD  
 GROUNDWATER ENTRY: DELAYED GROUNDWATER:  
 OBSERVATIONS: Groundwater not detected at time of drilling

SHEET 1 OF 1  
 PROJECT NO:  
 RIG: CME-750  
 DATE: 3-28-01  
 NORTH: 211899.6  
 EAST: 533066.5

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REG (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_d$ (pcf)	PP (KSF)				
0									Stiff, damp, dark gray, Silty LEAN CLAY (CL) (topsoil)			
									Stiff, damp, reddish brown, Silty LEAN CLAY (CL) with gravel		2	
									Stiff, damp, red, FAT CLAY (CH)		4	
5									No refusal		6.5	
									BOTTOM OF BORING A-01-37 AT 6.5 FEET			
10												
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-38**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams

DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION:

ELEVATION DATUM: NGVD

DATE: 3-28-01

GROUNDWATER ENTRY:

DELAYED GROUNDWATER:

NORTH: 211910.6

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533058.3

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RCD LENGTH	RCD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_w$ (pcf)	PP (KSF)				
0									Stiff, damp, dark grey brown, Silty LEAN CLAY (CL) (topsoil)			
									Stiff, damp, reddish brown, Gravelly LEAN CLAY (CL)		2	
									Stiff, damp, red, FAT CLAY (CH)		4	
5									Hard at 5.2' to 5.9'			
									No refusal		6.5	
									BOTTOM OF BORING A-01-38 AT 6.5 FEET			
10												
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-39**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks SHEET 1 OF 1  
 PROJECT LOCATION: Fort Leonard Wood, Missouri PROJECT NO:  
 LOGGED BY: B. Adams DRILLING CO: Corps of Engineers RIG: CME-750  
 SURFACE ELEVATION: ELEVATION DATUM: NGVD DATE: 3-28-01  
 GROUNDWATER ENTRY: DELAYED GROUNDWATER: NORTH: 211922.6  
 OBSERVATIONS: Groundwater not detected at time of drilling EAST: 533047.2

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	ROD LENGTH	ROD/REG (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_w$ (pcf)	PP (KSF)	$Q_u$ (ksf)			
0												
									Stiff, damp, dark gray brown, Silty LEAN CLAY (CL) (topsoil)			
											1.5	
									Stiff, damp, reddish brown, Gravelly LEAN CLAY (CL)			
									No refusal		3.5	
									BOTTOM OF BORING A-01-39 AT 3.5 FEET			
5												
10												
15												
20												
25												

# GRAPHIC BORING LOG

**A-01-40**

PROJECT NAME: Fort Leonard Wood FY01 BCT Barracks

SHEET 1 OF 1

PROJECT LOCATION: Fort Leonard Wood, Missouri

PROJECT NO:

LOGGED BY: B. Adams

DRILLING CO: Corps of Engineers

RIG: CME-750

SURFACE ELEVATION:

ELEVATION DATUM: NGVD

DATE: 3-28-01

GROUNDWATER ENTRY:

DELAYED GROUNDWATER:

NORTH: 211934.5

OBSERVATIONS: Groundwater not detected at time of drilling

EAST: 533038.2

DEPTH (feet)	SAMPLE DATA								DESCRIPTION	SYMBOL	ELEVATION (feet)	DRILLING METHOD
	TYPE	RECOVERY	RQD LENGTH	RQD/REC (%)	RESISTANCE IN COMPONENTS	WATER (%)	$\gamma_w$ (pcf)	PP (KSF)				
0									Stiff, damp, dark gray brown, Silty LEAN CLAY (CL) (topsoil)			
									Stiff, damp, red. Gravelly LEAN CLAY (CL)		1.5	
									No refusal		3.5	
									<b>BOTTOM OF BORING A-01-40 AT 3.5 FEET</b>			
5												
10												
15												
20												
25												

## SECTION 02315

EXCAVATION, FILLING AND BACKFILLING FOR BUILDINGS  
**08/98**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1556	(1990; R 1996el) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991; R 1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2216	(1998) Laboratory Determination of Water (Moisture) Content of Soil and Rock
ASTM D 2487	(1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 2937	(1994) Density of Soil in Place by the Drive-Cylinder Method
ASTM D 3017	(1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1998) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

## 1.2 DEGREE OF COMPACTION

Degree of compaction is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557, abbreviated as percent laboratory maximum density.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-06 Test Reports

##### Testing

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, SP-SC, CL, ML, CL-ML.

#### 2.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 75 mm. The Contracting Officer shall be notified of any contaminated materials.

#### 2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM, GP-GM, GW-GM, SW-SM, SP-SM, and SM shall be identified as cohesionless only when the fines are nonplastic.

#### 2.1.4 Expansive Soils

Expansive soils are defined as soils that have a plasticity index equal to or greater than 18 when tested in accordance with ASTM D 4318.

#### 2.1.5 Nonfrost Susceptible (NFS) Material

Nonfrost susceptible material shall be a uniformly graded washed sand with a maximum particle size of 18 mm and less than 5 percent passing the 0.075 mm size sieve, and with not more than 3 percent by weight finer than 0.02 mm grain size.

#### 2.1.6 Sand Backfill Behind Retaining Walls

Backfill behind retaining walls shall consist of a well graded clean sand or sand/gravel mixture with a maximum particle size of 19 mm and not more than 5 percent passing the 0.074 mm sieve. Well-graded sand or sand/gravel mixtures shall have a uniformity coefficient greater than 6.

#### 2.2 CAPILLARY WATER BARRIER

Capillary Water Barrier shall consist of clean, crushed, nonporous rock, crushed gravel, or uncrushed gravel. The maximum particle size shall be 37.5 mm and no more than 2 percent by weight shall pass the 4.75 mm size sieve.

### PART 3 EXECUTION

#### 3.1 CLEARING AND GRUBBING

The areas within lines 1.5 m outside of each building and structure line shall be cleared and grubbed of trees, stumps, roots, brush and other vegetation, debris, existing foundations, pavements, utility lines, structures, fences, and other items that would interfere with construction operations. Stumps, logs, roots, and other organic matter shall be completely removed and the resulting depressions shall be filled with satisfactory material, placed and compacted in accordance with paragraph FILLING AND BACKFILLING. Materials removed shall be disposed of in the designated waste disposal areas or as directed by the Contracting Officer.

#### 3.2 TOPSOIL

Topsoil shall be stripped to a depth of 300 millimeters below existing grade within the designated excavations and grading lines and deposited in storage piles for later use. Excess topsoil shall be disposed as specified for excess excavated material.

#### 3.3 EXCAVATION

Excavation shall conform to the dimensions and elevations indicated for each building, structure, and footing except as specified, and shall include trenching for utility and foundation drainage systems to a point 1.5 m beyond the building line of each building and structure, excavation for outside grease interceptors and all work incidental thereof. Excavation shall extend a sufficient distance from walls and footings to allow for placing and removal of forms. Excavations below indicated depths will not be permitted except to remove unsatisfactory material. Unsatisfactory material encountered below the grades shown shall be replaced with satisfactory material; and payment will be made in conformance with the CHANGES clause of the CONTRACT CLAUSES. Satisfactory material removed below



the depths indicated, without specific direction of the Contracting Officer, shall be replaced, at no additional cost to the Government, with satisfactory materials to the indicated excavation grade; except that concrete footings shall be increased in thickness to the bottom of the overdepth excavations and over-break in rock excavation. Satisfactory material shall be placed and compacted as specified in paragraph FILLING AND BACKFILLING. Determination of elevations and measurements of approved overdepth excavation of unsatisfactory material below grades indicated shall be done under the direction of the Contracting Officer.

### 3.4 DRAINAGE AND DEWATERING

#### 3.4.1 Drainage

Surface water shall be directed away from excavation and construction sites to prevent erosion and undermining of foundations. Diversion ditches, dikes and grading shall be provided and maintained as necessary during construction. Excavated slopes and backfill surfaces shall be protected to prevent erosion and sloughing. Excavation shall be performed so that the site, the area immediately surrounding the site, and the area affecting operations at the site shall be continually and effectively drained.

### 3.5 SHORING

Shoring, including sheet piling, shall be furnished and installed as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Shoring, bracing, and sheeting shall be removed as excavations are backfilled, in a manner to prevent caving.

### 3.6 CLASSIFICATION OF EXCAVATION

Excavation will be unclassified regardless of the nature of material encountered.

### 3.7 BLASTING

Blasting will not be permitted.

### 3.8 UTILITY AND DRAIN TRENCHES

Trenches for underground utilities systems and drain lines shall be excavated to the required alignments and depths. The bottoms of trenches shall be graded to secure the required slope and shall be tamped if necessary to provide a firm pipe bed. Recesses shall be excavated to accommodate bells and joints so that pipe will be uniformly supported for the entire length. Rock, where encountered, shall be excavated to a depth of at least 150 mm below the bottom of the pipe, and the overdepth shall be backfilled with satisfactory material placed and compacted in conformance with paragraph FILLING AND BACKFILLING.

### 3.9 BORROW

Where satisfactory materials are not available in sufficient quantity from required excavations, approved materials shall be obtained as specified in

## Section 02300 EARTHWORK.

## 3.10 EXCAVATED MATERIALS

Satisfactory excavated material required for fill or backfill shall be placed in the proper section of the permanent work required under this section or shall be separately stockpiled if it cannot be readily placed. Satisfactory material in excess of that required for the permanent work and all unsatisfactory material shall be disposed of as specified in Section 02300 EARTHWORK.

## 3.11 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Excavation to final grade shall not be made until just before concrete is to be placed. Approximately level surfaces shall be roughened, and sloped surfaces shall be cut as indicated into rough steps or benches to provide a satisfactory bond. Shales shall be protected from slaking and all surfaces shall be protected from erosion resulting from ponding or flow of water.

## 3.12 SUBGRADE PREPARATION

Unsatisfactory material in surfaces to receive fill or in excavated areas shall be removed and replaced with satisfactory materials as directed by the Contracting Officer. The surface shall be scarified to a depth of 150 mm before the fill is started. Sloped surfaces steeper than 1 vertical to 4 horizontal shall be plowed, stepped, benched, or broken up so that the fill material will bond with the existing material. When subgrades are less than the specified density, the ground surface shall be broken up to a minimum depth of 150 mm, pulverized, and compacted to the specified density. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 300 mm and compacted as specified for the adjacent fill. Material shall not be placed on surfaces that are muddy, frozen, or contain frost. Compaction shall be accomplished by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, or other approved equipment well suited to the soil being compacted. Minimum subgrade density shall be as specified in paragraph FILLING AND BACKFILLING.

## 3.13 FILLING AND BACKFILLING

Satisfactory materials shall be used in bringing fills and backfills to the lines and grades indicated and for replacing unsatisfactory materials. Satisfactory materials shall be placed in horizontal layers not exceeding 200 mm in loose thickness, or 150 mm when hand-operated compactors are used.

After placing, each layer shall be plowed, disked, or otherwise broken up, moistened or aerated as necessary, thoroughly mixed and compacted as specified. Backfilling shall not begin until construction below finish grade has been approved, underground utilities systems have been inspected, tested and approved, forms removed, and the excavation cleaned of trash and debris. Backfill shall be brought to indicated finish grade [and shall include backfill for outside grease interceptors. Backfill shall not be placed in wet or frozen areas. Where pipe is coated or wrapped for protection against corrosion, the backfill material up to an elevation 600 mm above sewer lines and 300 mm above other utility lines shall be free from

stones larger than 25 mm in any dimension. Heavy equipment for spreading and compacting backfill shall not be operated closer to foundation or retaining walls than a distance equal to the height of backfill above the top of footing; the area remaining shall be compacted in layers not more than 100 mm in compacted thickness with power-driven hand tampers suitable for the material being compacted. Backfill shall be placed carefully around pipes or tanks to avoid damage to coatings, wrappings, or tanks. Backfill shall not be placed against foundation walls prior to 7 days after completion of the walls. As far as practicable, backfill shall be brought up evenly on each side of the wall and sloped to drain away from the wall. Each layer of fill and backfill shall be compacted to not less than the percentage of maximum density specified below:

	Percent Laboratory maximum density	
	Cohesive material	Cohesionless material
<hr/>		
Fill, embankment, and backfill		
<hr/>		
Under structures, building slabs, steps, paved areas, around footings, and in trenches	90	95
Under sidewalks and grassed areas	85	90
[Expansive materials	Compacted to not less than 90 percent nor more than 93 percent]	
Nonfrost susceptible materials		95
<hr/>		
Subgrade		
<hr/>		
Under building slabs, steps, and paved areas, top 300 mm	90	95
Under sidewalks, top 150 mm	85	90

Approved compacted subgrades that are disturbed by the Contractor's operations or adverse weather shall be scarified and compacted as specified herein before to the required density prior to further construction thereon. Recomposition over underground utilities and heating lines shall be by hand tamping.

### 3.14 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or may be performed by the Contractor

subject to approval. Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted if necessary by the procedure described in ASTM D 2922, paragraph ADJUSTING CALIBRATION CURVE. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017.

The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer. ASTM D 2937 shall be used only for soft, fine-grained, cohesive soils. The following number of tests, if performed at the appropriate time, shall be the minimum acceptable for each type operation.

#### 3.14.1 In-Place Densities

In-place density and moisture content test results shall be included with the Contractor's daily construction quality control reports.

##### 3.14.1.1 In-Place Density of Subgrades

One test per 1000 square meters.

##### 3.14.1.2 In-Place Density of Fills and Backfills

One test per 930 square meters or fraction thereof of each lift for fill or backfill areas compacted by other than hand or hand-operated machines. The density for each lift of fill or backfill materials for trenches, pits, building perimeters or other structures or areas less than 1 meters in width, which are compacted with hand or hand-operated machines shall be tested as follows: One test per each area less than 100 linear meter in length. If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 at least twice daily.

#### 3.14.2 Moisture Content

In the stockpile, excavation or borrow areas, a minimum of two tests per day per type of material or source of materials being placed is required during stable weather conditions. During unstable weather, tests shall be made as dictated by local conditions and approved moisture content shall be tested in accordance with ASTM D 2216.

#### 3.14.3 Optimum Moisture and Laboratory Maximum Density

Tests shall be made for each type material or source of material, including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 250 cubic meters of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density will be made.

#### 3.15 CAPILLARY WATER BARRIER

Capillary water barrier under concrete floor and area-way slabs on grade

shall be placed directly on the subgrade and shall be compacted with a minimum of two passes of a hand-operated plate-type vibratory compactor.

### 3.16 GRADING

Areas within 1.5 m outside of each building and structure line shall be constructed true-to-grade, shaped to drain, and shall be maintained free of trash and debris until final inspection has been completed and the work has been accepted.

### 3.17 SPREADING TOPSOIL

Areas outside the building lines from which topsoil has been removed shall be topsoiled. The surface shall be free of materials that would hinder planting or maintenance operations. The subgrade shall be pulverized to a depth of 50 mm by disking or plowing for the bonding of topsoil with the subsoil. Topsoil shall then be uniformly spread, graded, and compacted to the thickness, elevations, slopes shown, and left free of surface irregularities. Topsoil shall be compacted by one pass of a cultipacker, roller, or other approved equipment weighing 1.46 kN/m to 2.34 kN/m of roller. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to seeding, planting, or proper grading.

### 3.18 PROTECTION

Settlement or washing that occurs in graded, topsoiled, or backfilled areas prior to acceptance of the work, shall be repaired and grades reestablished to the required elevations and slopes.

-- End of Section --

## SECTION 02316

EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS  
11/97

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1556	(1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)

## 1.2 DEGREE OF COMPACTION

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system

package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-06 Test Reports

Field Density Tests; GA-AO. Testing of Backfill Materials; GA-AO.

Copies of all laboratory and field test reports within 24 hours of the completion of the test.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Satisfactory Materials

Satisfactory materials shall comprise any materials classified by ASTM D 2487 as GW, GP, GM, GC, GM-GC, SW, SP, SM, SC, and CL.

#### 2.1.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills, trash, refuse, or backfills from previous construction. Unsatisfactory material also includes material classified as satisfactory which contains root and other organic matter, frozen material, and stones larger than 75 mm. The Contracting Officer shall be notified of any contaminated materials.

#### 2.1.3 Cohesionless and Cohesive Materials

Cohesionless materials shall include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials shall include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM shall be identified as cohesionless only when the fines are nonplastic.

#### 2.1.4 Rock

Rock shall consist of boulders measuring 1/2 cubic meter or more and materials that cannot be removed without systematic drilling and blasting such as rock material in ledges, bedded deposits, unstratified masses and conglomerate deposits, and below ground concrete or masonry structures, exceeding 1/2 cubic meter in volume, except that pavements shall not be considered as rock.

#### 2.1.5 Unyielding Material

Unyielding material shall consist of rock and gravelly soils with stones greater than 75 millimeters in any dimension or as defined by the pipe manufacturer, whichever is smaller.

#### 2.1.6 Unstable Material

Unstable material shall consist of materials too wet to properly support the

utility pipe, conduit, or appurtenant structure.

#### 2.1.7 Select Granular Material

Select granular material shall consist of well-graded sand, gravel, crushed gravel, crushed stone or crushed slag composed of hard, tough and durable particles, and shall contain not more than 10 percent by weight of material passing a 0.075 mm mesh sieve and no less than 95 percent by weight passing the 25 mm sieve. The maximum allowable aggregate size shall be 25 millimeters, or the maximum size recommended by the pipe manufacturer, whichever is smaller.

#### 2.1.8 Initial Backfill Material

Initial backfill shall consist of select granular material or satisfactory materials free from rocks 15 millimeters or larger in any dimension or free from rocks of such size as recommended by the pipe manufacturer, whichever is smaller.

### 2.2 PLASTIC MARKING TAPE

Plastic marking tape shall be acid and alkali-resistant polyethylene film, 152 mm wide with minimum thickness of 0.102 mm. Tape shall have a minimum strength of 12.1 MPa lengthwise and 10.3 MPa crosswise. The tape shall be manufactured with integral wires, foil backing or other means to enable detection by a metal detector when the tape is buried up to 1 meter deep. The tape shall be of a type specifically manufactured for marking and locating underground utilities. The metallic core of the tape shall be encased in a protective jacket or provided with other means to protect it from corrosion. Tape color shall be as specified in TABLE 1 and shall bear a continuous printed inscription describing the specific utility.

TABLE 1. Tape Color

Red:	Electric
Yellow:	Gas, Oil, Dangerous Materials
Orange:	Telephone, Telegraph, Television, Police, and Fire Communications
Blue:	Water Systems
Green:	Sewer Systems

## PART 3 EXECUTION

### 3.1 EXCAVATION

Excavation shall be performed to the lines and grades indicated. Rock excavation shall include removal and disposition of material defined as rock in paragraph MATERIALS. Earth excavation shall include removal and disposal of material not classified as rock excavation. During excavation, material satisfactory for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench equal to 1/2 the depth of the excavation, but in no instance closer than 600 mm. Excavated material not required or not satisfactory for backfill shall be disposed of by the contractor. Grading shall be done as may be necessary to prevent surface



water from flowing into the excavation, and any water accumulating shall be removed to maintain the stability of the bottom and sides of the excavation.

Unauthorized overexcavation shall be backfilled in accordance with paragraph BACKFILLING AND COMPACTION at no additional cost to the Government.

#### 3.1.1 Trench Excavation Requirements

The trench shall be excavated as recommended by the manufacturer of the pipe to be installed. Trench walls below the top of the pipe shall be sloped, or made vertical, and of such width as recommended in the manufacturer's installation manual. Where no manufacturer's installation manual is available, trench walls shall be made vertical. Trench walls more than 1.2 meters high shall be shored, cut back to a stable slope, or provided with equivalent means of protection for employees who may be exposed to moving ground or cave in. Vertical trench walls more than 2 meters high shall be shored. Trench walls which are cut back shall be excavated to at least the angle of repose of the soil. Special attention shall be given to slopes which may be adversely affected by weather or moisture content. The trench width below the top of pipe shall not exceed 600 mm plus pipe outside diameter (O.D.) for pipes of less than 600 mm inside diameter and shall not exceed 900 mm plus pipe outside diameter for sizes larger than 600 mm inside diameter. Where recommended trench widths are exceeded, redesign, stronger pipe, or special installation procedures shall be utilized by the Contractor. The cost of redesign, stronger pipe, or special installation procedures shall be borne by the Contractor without any additional cost to the Government.

##### 3.1.1.1 Bottom Preparation

The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. Stones of 75 millimeters or greater in any dimension, or as recommended by the pipe manufacturer, whichever is smaller, shall be removed to avoid point bearing.

##### 3.1.1.2 Removal of Unyielding Material

Where overdepth is not indicated and unyielding material is encountered in the bottom of the trench, such material shall be removed 100 millimeters below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

##### 3.1.1.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Government.

##### 3.1.1.4 Excavation for Appurtenances

Excavation for manholes, catch-basins, inlets, or similar structures shall be sufficient to leave at least 300 mm clear between the outer structure surfaces and the face of the excavation or support members of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Rock shall be cleaned of loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Loose disintegrated rock and thin strata shall be removed. Removal of unstable material shall be as specified above.

When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

#### 3.1.1.5 Jacking, Boring, and Tunneling

Unless otherwise indicated, excavation shall be by open cut except that sections of a trench may be jacked, bored, or tunneled if, in the opinion of the Contracting Officer, the pipe, cable, or duct can be safely and properly installed and backfill can be properly compacted in such sections.

#### 3.1.2 Stockpiles

Stockpiles of satisfactory materials shall be placed and graded as specified. Stockpiles shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed by rubber-tired equipment, excavated satisfactory and unsatisfactory materials shall be separately stockpiled. Stockpiles of satisfactory materials shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, such material shall be removed and replaced with satisfactory material from approved sources at no additional cost to the Government. Locations of stockpiles of satisfactory materials shall be subject to prior approval of the Contracting Officer.

### 3.2 BACKFILLING AND COMPACTION

Backfill material shall consist of satisfactory material, select granular material, or initial backfill material as required. Backfill shall be placed in layers not exceeding 150 mm loose thickness for compaction by hand operated machine compactors, and 200 mm loose thickness for other than hand operated machines, unless otherwise specified. Each layer shall be compacted to at least 95 percent maximum density for cohesionless soils and 90 percent maximum density for cohesive soils, unless otherwise specified.

#### 3.2.1 Trench Backfill

Trenches shall be backfilled to the grade shown. The trench shall be backfilled to 0.15 meters above the top of pipe prior to performing the required pressure tests. The joints and couplings shall be left uncovered during the pressure test.

##### 3.2.1.1 Replacement of Unyielding Material

Unyielding material removed from the bottom of the trench shall be replaced with select granular material or initial backfill material.

#### 3.2.1.2 Replacement of Unstable Material

Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm loose thickness.

#### 3.2.1.3 Bedding and Initial Backfill

Class I Bedding and initial backfill shall consist of select granular material of thickness shown. Initial backfill material shall be placed and compacted with approved tampers to a height of at least 300 mm above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.

#### 3.2.1.4 Final Backfill

The remainder of the trench, except for special materials for roadways, railroads and airfields, shall be filled with satisfactory material. Backfill material shall be placed and compacted as follows:

- a. Roadways: Backfill shall be placed up to the elevation at which the requirements in Section 02300 EARTHWORK control. Water flooding or jetting methods of compaction will not be permitted.
- b. Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas: Backfill shall be deposited in layers of a maximum of 300 mm loose thickness, and compacted to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. Compaction by water flooding or jetting will not be permitted. This requirement shall also apply to all other areas not specifically designated above.

#### 3.2.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for 3 days, backfill shall be placed in such a manner that the structure will not be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be brought up evenly on all sides of the structure to prevent eccentric loading and excessive stress.

### 3.3 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

#### 3.3.1 Water Lines

Trenches shall be of a depth to provide a minimum cover of 1.2 meters from

the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe. For fire protection yard mains or piping, an additional 300 millimeters of cover is required.

### 3.3.2 Electrical Distribution System

Direct burial cable and conduit or duct line shall have a minimum cover of 600 mm from the finished grade, unless otherwise indicated. Special trenching requirements for direct-burial electrical cables and conduits are specified in Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

### 3.3.3 Plastic Marking Tape

Warning tapes shall be installed directly above the pipe, at a depth of 450 millimeters below finished grade unless otherwise shown.

## 3.4 TESTING

Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government.

### 3.4.1 Testing Facilities

Tests shall be performed by an approved commercial testing laboratory or may be tested by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved by the Contracting Officer.

### 3.4.2 Testing of Backfill Materials

Classification of backfill materials shall be determined in accordance with ASTM D 2487 and the moisture-density relations of soils shall be determined in accordance with ASTM D 1557. A minimum of one soil classification and one moisture-density relation test shall be performed on each different type of material used for bedding and backfill.

### 3.4.3 Field Density Tests

Tests shall be performed in sufficient numbers to ensure that the specified density is being obtained. A minimum of one field density test per lift of backfill for every 175 meters of installation shall be performed. One moisture density relationship shall be determined for every 1500 cubic meters of material used. Field in-place density shall be determined in accordance with ASTM D 1556 or ASTM D 2167 ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using the sand cone method as described in paragraph Calibration of the ASTM publication. ASTM D 2922 results in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job, on each different type of material encountered, at intervals as directed by the Contracting Officer. Copies of calibration curves, results of calibration tests, and field and laboratory density tests

shall be furnished to the Contracting Officer. Trenches improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to the Government.

#### 3.4.4 Displacement of Sewers

After other required tests have been performed and the trench backfill compacted to the finished grade surface, the pipe shall be inspected to determine whether significant displacement has occurred. This inspection shall be conducted in the presence of the Contracting Officer. Pipe sizes larger than 900 mm shall be entered and examined, while smaller diameter pipe shall be inspected by shining a light or laser between manholes or manhole locations, or by the use of television cameras passed through the pipe. If, in the judgement of the Contracting Officer, the interior of the pipe shows poor alignment or any other defects that would cause improper functioning of the system, the defects shall be remedied as directed at no additional cost to the Government.

-- End of Section --

## SECTION 02510

## WATER DISTRIBUTION SYSTEM

**04/98**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN RAILWAY ENGINEERING &amp; MAINTENANCE-OF-WAY ASSOCIATION (AREMA)

AREMA Manual (1999) Manual for Railway Engineering (4 Vol.)

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(1997a) Carbon Structural Steel
ASTM A 53	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM B 88	(1996) Seamless Copper Water Tube
ASTM B 88M	(1996) Seamless Copper Water Tube (Metric)
ASTM C 76	(1999) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 76M	(1999a) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM D 1599	(1999) Resistance to Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings
ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 1785	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D 2241	(1996b) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2464	(1999) Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80

ASTM D 2466	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D 2467	(1999) Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D 2564	(1996a) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2657	(1997) Heat Fusion Joining Polyolefin Pipe and Fittings
ASTM D 2774	(1994) Underground Installation of Thermoplastic Pressure Piping
ASTM D 2855	(1996) Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D 2996	(1995) Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 2997	(1995) Centrifugally Cast "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe
ASTM D 3139	(1998) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 3839	(1994a) Underground Installation of "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe
ASTM D 4161	(1996) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe Joints Using Elastomeric Seals
ASTM F 477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 1483	(1998) Oriented Poly(Vinyl Chloride), PVC0, Pressure Pipe

## ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.1	(1998) Cast Iron Pipe Flanges and Flanged Fittings
ASME B16.3	(1992) Malleable Iron Threaded Fittings
ASME B16.26	(1988) Cast Copper Alloy Fittings for Flared

## Copper Tubes

ASME B36.10M (1996) Welded and Seamless Wrought Steel Pipe

## AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA B300 (1992) Hypochlorites

AWWA B301 (1992) Liquid Chlorine

AWWA C104 (1995) Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

AWWA C105 (1993) Polyethylene Encasement for Ductile-Iron Pipe Systems

AWWA C110 (1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids

AWWA C111 (1995) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

AWWA C115 (1996) Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges

AWWA C151 (1996) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids

AWWA C153 (1994; Errata Nov 1996) Ductile-Iron Compact Fittings, 3 In. Through 24 In. (76 mm through 610 mm) and 54 In. through 64 In. (1,400 mm through 1,600 mm) for Water Service

AWWA C200 (1997) Steel Water Pipe - 6 In. (150 mm) and Larger

AWWA C203 (1997) Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot-Applied

AWWA C205 (1995) Cement-Mortar Protective Lining and Coating for Steel Water Pipe - 4 In. (100 mm) and Larger - Shop Applied

AWWA C207 (1994) Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In. (100 mm through 3,600 mm)

AWWA C208 (1996) Dimensions for Fabricated Steel Water Pipe Fittings

AWWA C300 (1997) Reinforced Concrete Pressure Pipe, Steel-Cylinder Type, for Water and Other



## Liquids

AWWA C301	(1992) Prestressed Concrete Pressure Pipe, Steel-Cylinder Type, for Water and Other Liquids
AWWA C303	(1995) Concrete Pressure Pipe, Bar-Wrapped, Steel Cylinder Type
AWWA C500	(1993; C500a) Metal-Sealed Gate Valves for Water Supply Service
AWWA C502	(1994; C502a) Dry-Barrel Fire Hydrants
AWWA C503	(1997) Wet-Barrel Fire Hydrants
AWWA C504	(1994) Rubber-Seated Butterfly Valves
AWWA C509	(1994; Addendum 1995) Resilient-Seated Gate Valves for Water Supply Service
AWWA C600	(1993) Installation of Ductile-Iron Water Mains and Their Appurtenances
AWWA C606	(1997) Grooved and Shouldered Joints
AWWA C651	(1992) Disinfecting Water Mains
AWWA C700	(1995) Cold-Water Meters - Displacement Type, Bronze Main Case
AWWA C701	(1988) Cold-Water Meters - Turbine Type, for Customer Service
AWWA C702	(1992) Cold-Water Meters - Compound Type
AWWA C703	(1996) Cold-Water Meters - Fire Service Type
AWWA C704	(1992) Propeller-Type Meters Waterworks Applications
AWWA C706	(1996) Direct-Reading, Remote-Registration Systems for Cold-Water Meters
AWWA C707	(1982; R 1992) Encoder-Type Remote-Registration Systems for Cold-Water Meters
AWWA C800	(1989) Underground Service Line Valves and Fittings
AWWA C900	(1997; C900a) Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. Through 12 In., for Water Distribution

AWWA C901	(1996) Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. Through 3 In., for Water Service
AWWA C905	(1997) Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 In. Through 36 In.
AWWA C909	(1998) Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe, 4 IN through 12 IN (100 mm through 300 mm), for Water Distribution
AWWA C950	(1995) Fiberglass Pressure Pipe
AWWA M23	(1980) Manual: PVC Pipe - Design and Installation

#### ASBESTOS CEMENT PIPE PRODUCERS ASSOCIATION (ACPPA)

ACPPA Work Practices	(1988) Recommended Work Practices for A/C Pipe
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#### DUCTILE IRON PIPE RESEARCH ASSOCIATION (DIPRA)

DIPRA-Restraint Design	(1997) Thrust Restraint Design for Ductile Iron Pipe
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#### MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves
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#### NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 24	(1995) Installation of Private Fire Service Mains and Their Appurtenances
NFPA 49	(1994) Hazardous Chemicals Data
NFPA 325-1	(1994) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids
NFPA 704	(1996) Identification of the Fire Hazards of Materials for Emergency Response
NFPA 1961	(1997) Fire Hose

#### NSF INTERNATIONAL (NSF)

NSF 14	(1998) Plastics Piping Components and Related Materials
NSF 61	(1999) Drinking Water System Components -

## Health Effects (Sections 1-9)

## THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 21	(1991) White or Colored Silicone Alkyd Paint
SSPC Paint 25	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)

## 1.2 PIPING

This section covers water distribution service lines, and connections to building service at a point approximately 1.5 m outside buildings and structures to which service is required. The Contractor shall have a copy of the manufacturer's recommendations for each material or procedure to be utilized available at the construction site at all times.

## 1.2.1 Service Lines

Piping for water service lines less than 80 mm in diameter shall be, polyvinyl chloride (PVC) plastic, polyethylene, or copper tubing, unless otherwise shown or specified. Piping for water service lines 80 mm and larger shall be ductile iron, or polyvinyl chloride (PVC) plastic, unless otherwise shown or specified.

## 1.2.2 Distribution Lines 80 mm

Piping for water distribution lines 80 mm shall be ductile iron, polyvinyl chloride (PVC) otherwise shown or specified.

## 1.2.3 Supply Lines 80 mm

Piping for water supply lines 80 mm shall be ductile iron, polyvinyl chloride (PVC) plastic. Unless otherwise shown or specified.

## 1.2.4 Sprinkler Supply Lines

Piping for water lines supplying sprinkler systems for building fire protection shall conform to NFPA 24 from the point of connection with the water distribution system to the building 1.5 m line.

## 1.2.5 Potable Water Lines

Piping and components of potable water systems which come in contact with the potable water shall conform to NSF 61.

## 1.2.6 Plastic Piping System

Plastic piping system components (PVC, and polyethylene), intended for transportation of potable water shall comply with NSF 14 and be legibly marked with their symbol.

## 1.2.7 Excavation, Trenching, and Backfilling

Excavation, trenching, and backfilling shall be in accordance with the applicable provisions of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, except as modified herein.

### 1.3 MANUFACTURER'S REPRESENTATIVE

The Contractor shall have a manufacturer's field representative present at the jobsite during the installation and testing of PE, pipe to provide technical assistance and to verify that the materials are being installed in accordance with the manufacturer's prescribed procedures. When the representative feels that the Contractor is installing and testing the PE, pipe in a satisfactory manner, certification shall be written to note which individuals employed by the Contractor are capable of properly installing the pipe. The field representative shall advise the Contractor of unsatisfactory conditions immediately when they occur. Such conditions include improper diameter of pipe ends, damaged interior liner, poorly prepared joints, improper curing of joints, moving pipe before joints are cured, bending pipe to follow abrupt changes in trench contours, leaving pipe ends open in trench overnight, not properly drying joints after rain storms, exceeding effective adhesive life, sharp objects in trench bed, backfill that could damage pipe, improper procedure for concrete encasement of pipe, omission of thrust blocks at changes in direction or any other condition which could have an adverse effect on the satisfactory completion and operation of the piping system.

### 1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

SD-06 Test Reports

Bacteriological Disinfection

Test results from commercial laboratory verifying disinfection.

SD-08 Manufacturer's Instructions

Installation

The manufacturer's recommendations for each material or procedure to be utilized.

Waste Water Disposal Method; GA-AO.

The method proposed for disposal of waste water from hydrostatic tests and disinfection, prior to performing hydrostatic tests.

#### Satisfactory Installation

A statement signed by the principal officer of the contracting firm stating that the installation is satisfactory and in accordance with the contract drawings and specifications, and the manufacturer's prescribed procedures and techniques, upon completion of the project and before final acceptance.

#### SD-07 Certificates

##### Manufacturer's Representative

The name and qualifications of the manufacturer's representative and written certification from the manufacturer that the representative is technically qualified in all phases of PE, RTRP, and/or RPMP pipe laying and jointing and experienced to supervise the work and train the Contractor's field installers, prior to commencing installation.

##### Installation

A statement signed by the manufacturer's field representative certifying that the Contractor's personnel are capable of properly installing the pipe on the project.

##### Meters

Manufacturer's certificate stating that each meter furnished has been tested for accuracy of registration and compliance with the accuracy and capacity requirements of the appropriate AWWA standard.

## 1.5 HANDLING

Pipe and accessories shall be handled to ensure delivery to the trench in sound, undamaged condition, including no injury to the pipe coating or lining. If the coating or lining of any pipe or fitting is damaged, the repair shall be made by the Contractor in a satisfactory manner, at no additional cost to the Government. No other pipe or material shall be placed inside a pipe or fitting after the coating has been applied. Pipe shall be carried into position and not dragged. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. The interior of pipe and accessories shall be thoroughly cleaned of foreign matter before being lowered into the trench and shall be kept clean during laying operations by plugging or other approved method. Before installation, the pipe shall be inspected for defects. Material found to be defective before or after laying shall be replaced with sound material without additional expense to the Government. Rubber gaskets that are not to be installed immediately shall be stored in a cool and dark place.

### 1.5.1 Coated and Wrapped Steel Pipe

Coated and wrapped steel pipe shall be handled in conformance with AWWA C203.

### 1.5.2 Polyethylene (PE) Pipe Fittings and Accessories

PE pipe, fittings, and accessories shall be handled in conformance with AWWA C901.

### 1.5.3 Miscellaneous Plastic Pipe and Fittings

Polyvinyl Chloride (PVC), pipe and fittings shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325-1.

## PART 2 PRODUCTS

### 2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.

#### 2.1.1 Plastic Pipe

##### 2.1.1.1 PE Plastic Pipe

Pipe, tubing, and heat-fusion fittings shall conform to AWWA C901.

##### 2.1.1.2 PVC Plastic Pipe

Pipe, couplings and fittings shall be manufactured of material conforming to ASTM D 1784, Class 12454B.

#### a. Pipe Less Than 100 mm Diameter:

(1) Screw-Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 Schedule 80, with joints meeting requirements of 1.03 MPa working pressure, 1.38 MPa hydrostatic test pressure, unless otherwise shown or specified. Pipe couplings when used, shall be tested as required by ASTM D 2464.

(2) Elastomeric-Gasket Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 Schedule 40, with joints meeting the requirements of 1.03 MPa working pressure, 1.38 MPa hydrostatic test pressure, unless otherwise shown or specified, or it may be pipe conforming to requirements of ASTM D 2241, elastomeric joint, with the following applications:

SDR	Maximum Working Pressure MPa	Minimum Hydrostatic Pressure MPa
26	0.689	0.917
21	0.827	1.103
17	1.034	1.379

SDR	Maximum Working Pressure MPa	Minimum Hydrostatic Pressure MPa
13.5	1.379	1.834

(3) Solvent Cement Joint: Pipe shall conform to dimensional requirements of ASTM D 1785 or ASTM D 2241 with joints meeting the requirements of 1.03 MPa working pressure and 1.38 MPa hydrostatic test pressure.

- b. Pipe 100 through 300 mm Diameter: Pipe, couplings and fittings shall conform to AWWA C900, Class 150, CIOD pipe dimensions, elastomeric-gasket joint, unless otherwise shown or specified.
- c. Pipe 350 through 900 mm Diameter: Pipe shall conform to AWWA C905 unless otherwise shown or specified.

#### 2.1.2 Ductile-Iron Pipe

Ductile-iron pipe shall conform to AWWA C151, working pressure not less than 1.03 MPa, unless otherwise shown or specified. Pipe shall be cement-mortar lined in accordance with AWWA C104. Linings shall be standard. When installed underground, pipe shall be encased with 0.2 mm thick polyethylene in accordance with AWWA C105. Flanged ductile iron pipe with threaded flanges shall be in accordance with AWWA C115.

#### 2.1.3 Copper Tubing

Copper tubing shall conform to ASTM B 88M , Type K, annealed.

### 2.2 FITTINGS AND SPECIALS

#### 2.2.1 PVC Pipe System

- a. For pipe less than 100 mm diameter, fittings for threaded pipe shall conform to requirements of ASTM D 2464, threaded to conform to the requirements of ASME B1.20.1 for use with Schedule 80 pipe and fittings; fittings for solvent cement jointing shall conform to ASTM D 2466 or ASTM D 2467; and fittings for elastomeric-gasket joint pipe shall be iron conforming to AWWA C110 or AWWA C111. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104.
- b. For pipe 100 mm diameter and larger, fittings and specials shall be iron, bell end in accordance with AWWA C110, 1.03 MPa pressure rating unless otherwise shown or specified, except that profile of bell may have special dimensions as required by the pipe manufacturer; or fittings and specials may be of the same material as the pipe with elastomeric gaskets, all in conformance with AWWA C900. Iron fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104. Fittings shall be bell and spigot or plain end pipe, or as applicable. Ductile

iron compact fittings shall be in accordance with AWWA C153.

#### 2.2.2 Ductile-Iron Pipe System

Fittings and specials shall be suitable for 1.03 MPa pressure rating, unless otherwise specified. Fittings and specials for mechanical joint pipe shall conform to AWWA C110. Fittings and specials for use with push-on joint pipe shall conform to AWWA C110 and AWWA C111. Fittings and specials for grooved and shouldered end pipe shall conform to AWWA C606. Fittings and specials shall be cement-mortar lined (standard thickness) in accordance with AWWA C104. Ductile iron compact fittings shall conform to AWWA C153.

#### 2.2.3 Copper Tubing System

Fittings and specials shall be flared and conform to ASME B16.26.

### 2.3 JOINTS

#### 2.3.1 Plastic Pipe Jointing

##### 2.3.1.1 PE Pipe

Joints for pipe fittings and couplings shall be strong tight joints as specified for PE in Paragraph INSTALLATION. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendation, and as approved by the Contracting Officer.

##### 2.3.1.2 PVC Pipe

Joints, fittings, and couplings shall be as specified for PVC pipe. Joints connecting pipe of differing materials shall be made in accordance with the manufacturer's recommendations, and as approved by the Contracting Officer.

#### 2.3.2 Ductile-Iron Pipe Jointing

- a. Mechanical joints shall be of the stuffing box type and shall conform to AWWA C111.
- b. Push-on joints shall conform to AWWA C111.
- c. Rubber gaskets and lubricants shall conform to the applicable requirements of AWWA C111.

#### 2.3.3 Bonded Joints

A metallic bond shall be provided at each joint, including joints made with flexible couplings, caulking, or rubber gaskets, of ferrous metallic piping to effect continuous conductivity. The bond wire shall be Size 1/0 copper conductor suitable for direct burial shaped to stand clear of the joint. The bond shall be of the thermal weld type.

#### 2.3.4 Isolation Joints

Isolation joints shall be installed between nonthreaded ferrous and



nonferrous metallic pipe, fittings and valves. Isolation joints shall consist of a sandwich-type flange isolation gasket of the dielectric type, isolation washers, and isolation sleeves for flange bolts. Isolation gaskets shall be full faced with outside diameter equal to the flange outside diameter. Bolt isolation sleeves shall be full length. Units shall be of a shape to prevent metal-to-metal contact of dissimilar metallic piping elements.

- a. Sleeve-type couplings shall be used for joining plain end pipe sections. The two couplings shall consist of one steel middle ring, two steel followers, two gaskets, and the necessary steel bolts and nuts to compress the gaskets.
- b. Split-sleeve type couplings may be used in aboveground installations when approved in special situations and shall consist of gaskets and a housing in two or more sections with the necessary bolts and nuts.

#### 2.3.5 Copper Tubing Jointing

Joints shall be compression-pattern flared and shall be made with the specified fittings.

### 2.4 VALVES

#### 2.4.1 Check Valves

Check valves shall be designed for a minimum working pressure of 1.03 MPa or as indicated. Valves shall have a clear waterway equal to the full nominal diameter of the valve. Valves shall open to permit flow when inlet pressure is greater than the discharge pressure, and shall close tightly to prevent return flow when discharge pressure exceeds inlet pressure. The size of the valve, working pressure, manufacturer's name, initials, or trademark shall be cast on the body of each valve. Valves 50 mm and larger shall be outside lever and spring outside lever and weight type.

- a. Valves 50 mm and smaller shall be all bronze designed for screwed fittings, and shall conform to MSS SP-80, Class 150, Types 3 and 4 as suitable for the application.
- b. Valves larger than 50 mm shall be iron body, bronze mounted, shall have flanged ends, and shall be the non-slam type. Flanges shall be the Class 125 type conforming to ASME B16.1.

#### 2.4.2 Gate Valves

Gate valves shall be designed for a working pressure of not less than 1.03 MPa. Valve connections shall be as required for the piping in which they are installed. Valves shall have a clear waterway equal to the full nominal diameter of the valve, and shall be opened by turning counterclockwise. The operating nut or wheel shall have an arrow, cast in the metal, indicating the direction of opening.

- a. Valves smaller than 80 mm shall be all bronze and shall conform to MSS SP-80, Type 1, Class 150.

- b. Valves 80 mm and larger shall be iron body, bronze mounted, and shall conform to AWWA C500. Flanges shall not be buried. An approved pit shall be provided for all flanged connections.
- c. Resilient-Seated Gate Valves: For valves 80 to 300 mm in size, resilient-seated gate valves shall conform to AWWA C509.

#### 2.4.3 Vacuum and Air Relief Valves

Vacuum and air relief valves shall be of the size shown and shall be of a type that will release air and prevent the formation of a vacuum. The valves shall automatically release air when the lines are being filled with water and shall admit air into the line when water is being withdrawn in excess of the inflow. Valves shall be iron body with bronze trim and stainless steel float.

#### 2.4.4 Indicator Post for Valves

Each valve shown on the drawings with the designation "P.I.V." shall be equipped with indicator post conforming to the requirements of NFPA 24. Operation shall be by a wrench which shall be attached to each post.

#### 2.5 VALVE BOXES

Valve boxes shall be cast iron or concrete, except that concrete boxes may be installed only in locations not subjected to vehicular traffic. Cast-iron boxes shall be extension type with slide-type adjustment and with flared base. The minimum thickness of metal shall be 5 mm. Concrete boxes shall be the standard product of a manufacturer of precast concrete equipment. The word "WATER" shall be cast in the cover. The box length shall adapt, without full extension, to the depth of cover required over the pipe at the valve location.

#### 2.6 VALVE PITS

Valve pits shall be constructed at locations indicated or as required above and in accordance with the details shown. Concrete shall have compressive strength of 21 MPa in accordance with Section 03300CAST-IN-PLACE STRUCTURAL CONCRETE.

#### 2.7 FIRE HYDRANTS

Hydrants shall be dry-barrel type conforming to AWWA C502 with valve opening at least 125 mm in diameter and designed so that the flange at the main valve seat can be removed with the main valve seat apparatus remaining intact, closed and reasonably tight against leakage and with a breakable valve rod coupling and breakable flange connections located no more than 200 mm above the ground grade. Hydrants shall have a 150 mm bell connection, two 65 mm hose connections and one 115 mm pumper connection. Outlets shall have American National Standard fire-hose coupling threads. Working parts shall be bronze. Design, material, and workmanship shall be equal to the latest stock pattern ordinarily produced by the manufacturer. Hydrants shall be painted with 1 coat, of the installation's standard colors: dark

brown (FED-STD-595-A-200059). Suitable bronze adapter for the 115 mm each outlet, with caps, shall be furnished.

## 2.8 MISCELLANEOUS ITEMS

### 2.8.1 Service Clamps

Service clamps shall have a pressure rating not less than that of the pipe to be connected and shall be either the single or double flattened strap type. Clamps shall have a galvanized malleable-iron body with cadmium plated straps and nuts. Clamps shall have a rubber gasket cemented to the body.

### 2.8.2 Service Stops

Service stops shall be water-works inverted-ground-key type, oval or round flow way, tee handle, without drain. Pipe connections shall be suitable for the type of service pipe used. All parts shall be of bronze with female iron-pipe-size connections or compression-pattern flared tube couplings, and shall be designed for a hydrostatic test pressure not less than 1.375 MPa.

### 2.8.3 Tapping Sleeves

Tapping sleeves of the sizes indicated for connection to existing main shall be the cast gray, ductile, or malleable iron, split-sleeve type with flanged or grooved outlet, and with bolts, follower rings and gaskets on each end of the sleeve. Construction shall be suitable for a maximum working pressure of 1.03 MPa. Bolts shall have square heads and hexagonal nuts. Longitudinal gaskets and mechanical joints with gaskets shall be as recommended by the manufacturer of the sleeve. When using grooved mechanical tee, it shall consist of an upper housing with full locating collar for rigid positioning which engages a machine-cut hole in pipe, encasing an elastomeric gasket which conforms to the pipe outside diameter around the hole and a lower housing with positioning lugs, secured together during assembly by nuts and bolts as specified, pretorqued to 67.8 Newton meters.

### 2.8.4 Service Boxes

Service boxes shall be cast iron or concrete and shall be extension service boxes of the length required for the depth of the line, with either screw or slide-type adjustment. The boxes shall have housings of sufficient size to completely cover the service stop or valve and shall be complete with identifying covers.

### 2.8.5 Disinfection

Chlorinating materials shall conform to the following:

Chlorine, Liquid: AWWA B301.

Hypochlorite, Calcium and Sodium: AWWA B300.

### 2.8.6 Meters

Meters shall be the type and size as specified. Meters of each of the various types furnished and installed shall be supplied by one manufacturer.

#### 2.8.6.1 Displacement Type

Displacement type meters shall conform to AWWA C700. Registers shall be straight-reading and shall read in cubic meters. Meters in sizes 13 through 25 mm shall not be frost-protection design. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct reading remote register designed in accordance with AWWA C706 or an encoder type remote register designed in accordance with AWWA C707. Meters shall comply with the accuracy and capacity requirements of AWWA C700.

#### 2.8.6.2 Turbine Type

Turbine type meters shall conform to AWWA C701 Class I Class I. The main casing shall be bronze cast iron protected by corrosion resistant coating with stainless steel external fasteners. Registers shall be straight-reading type, shall be permanently sealed open and shall read in cubic meters. Connections shall be suitable to the type of pipe and conditions encountered. Register type shall be a direct reading remote register designed in accordance with AWWA C706 or an encoder type remote register designed in accordance with AWWA C707. Meters shall comply with the accuracy and capacity requirements of AWWA C701 2.8.7 Meter Boxes

Meter boxes shall be of cast iron, concrete, or plastic. The boxes shall be of sufficient size to completely enclose the meter and shutoff valve or service stop. Meter boxes set in paved areas subject to vehicular traffic shall be cast iron, or concrete with cast iron lid and cast iron meter reader lid. Boxes set in sidewalks, not subject to vehicular traffic, shall use concrete covers with cast iron meter reader lids. Plastic boxes and lids shall not be used in unpaved areas or grass areas not subject to vehicular traffic. Box height shall extend from invert of the meter to final grade at the meter location. The lid shall have the word "WATER" cast in it.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Cutting of Pipe

Cutting of pipe shall be done in a neat and workmanlike manner without damage to the pipe. Unless otherwise recommended by the manufacturer and authorized by the Contracting Officer, cutting shall be done with an approved type mechanical cutter. Wheel cutter shall be used when practicable. Copper tubing shall be cut square and all burrs shall be removed. Squeeze type mechanical cutters shall not be used for ductile iron.

##### 3.1.2 Adjacent Facilities

###### 3.1.2.1 Sewer Lines

Where the location of the water pipe is not clearly defined in dimensions on the drawings, the water pipe shall not be laid closer horizontally than 3 m from a sewer except where the bottom of the water pipe will be at least 300 mm above the top of the sewer pipe, in which case the water pipe shall not be laid closer horizontally than 1.8 m from the sewer. Where water lines cross under gravity-flow sewer lines, the sewer pipe, for a distance of at least 3 m each side of the crossing, shall be fully encased in concrete or shall be made of pressure pipe with no joint located within 900 mm horizontally of the crossing. Water lines shall in all cases cross above sewage force mains or inverted siphons and shall be not less than 600 mm above the sewer main. Joints in the sewer main, closer horizontally than 900 mm to the crossing, shall be encased in concrete.

#### 3.1.2.2 Water Lines

Water lines shall not be laid in the same trench with sewer lines, gas lines, fuel lines, or electric wiring.

#### 3.1.2.3 Copper Tubing Lines

Copper tubing shall not be installed in the same trench with ferrous piping materials.

#### 3.1.2.4 Nonferrous Metallic Pipe

Where nonferrous metallic pipe, e.g. copper tubing, crosses any ferrous piping material, a minimum vertical separation of 300 mm shall be maintained between pipes.

#### 3.1.2.5 Casing Pipe

Where casing is required indicated, water pipe shall be encased in a sleeve of rigid conduit with the sleeve extending a distance of at least 1.5 meters beyond the edge of the pavement unless otherwise indicated. The pipe sleeve shall be steel, manufactured in accordance with AWWA C200, ASTM A 36/A 36M, , with a minimum wall thickness of 8 mm or reinforced concrete in accordance with ASTM C 76M and , Class V as specified for storm drains in Section 02630 STORM-DRAINAGE SYSTEM. A minimum clearance of at least 50 mm between the inner wall of the sleeve and the maximum outside diameter of the sleeved pipe and joints shall be provided. Sand bedding or suitable pipe support shall be provided for the water pipe through the sleeve. Sleeves of ferrous material shall be provided with corrosion protection as required in Section 13110 CATHODIC PROTECTION SYSTEM (SACRIFICIAL ANODE).

#### 3.1.2.6 Structures

Where water pipe is required to be installed within 1 m of existing structures, the water pipe shall be sleeved as required in Paragraph "Casing Pipe". The Contractor shall install the water pipe and sleeve ensuring that there will be no damage to the structures and no settlement or movement of foundations or footings.

#### 3.1.3 Joint Deflection

### 3.1.3.1 Offset for Flexible Plastic Pipe

Maximum offset in alignment between adjacent pipe joints shall be as recommended by the manufacturer and approved by the Contracting Officer, but shall not exceed 5 degrees.

### 3.1.3.2 Allowable for Ductile-Iron Pipe

The maximum allowable deflection shall be as given in AWWA C600. If the alignment requires deflection in excess of the above limitations, special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide angular deflections within the limit set forth.

### 3.1.4 Placing and Laying

Pipe and accessories shall be carefully lowered into the trench by means of derrick, ropes, belt slings, or other authorized equipment. Water-line materials shall not be dropped or dumped into the trench. Abrasion of the pipe coating shall be avoided. Except where necessary in making connections with other lines or as authorized by the Contracting Officer, pipe shall be laid with the bells facing in the direction of laying. The full length of each section of pipe shall rest solidly upon the pipe bed, with recesses excavated to accommodate bells, couplings, and joints. Pipe that has the grade or joint disturbed after laying shall be taken up and relaid. Pipe shall not be laid in water or when trench conditions are unsuitable for the work. Water shall be kept out of the trench until joints are complete. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no trench water, earth, or other substance will enter the pipes or fittings. Where any part of the coating or lining is damaged, the repair shall be made by and at the Contractor's expense in a satisfactory manner. Pipe ends left for future connections shall be valved, plugged, or capped, and anchored, as shown.

#### 3.1.4.1 Plastic Pipe Installation

RTRP shall be installed in accordance with ASTM D 3839. RPMP shall be installed in accordance with the manufacturer's recommendations. PE Pipe shall be installed in accordance with ASTM D 2774. PVC pipe shall be installed in accordance with AWWA M23.

#### 3.1.4.2 Piping Connections

Where connections are made between new work and existing mains, the connections shall be made by using specials and fittings to suit the actual conditions. When made under pressure, these connections shall be installed using standard methods as approved by the Contracting Officer. Connections to existing asbestos-cement pipe shall be made in accordance with ACPPA Work Practices.

#### 3.1.4.3 Penetrations

Pipe passing through walls of valve pits and structures shall be provided with ductile-iron or Schedule 40 steel wall sleeves. Annular space between walls and sleeves shall be filled with rich cement mortar. Annular space

between pipe and sleeves shall be filled with mastic.

#### 3.1.4.4 Flanged Pipe

Flanged pipe shall only be installed above ground or with the flanges in valve pits.

#### 3.1.5 Jointing

##### 3.1.5.1 PE Pipe Requirements

Jointing shall comply with ASTM D 2657, Technique I-Socket Fusion or Technique II-Butt Fusion.

##### 3.1.5.2 PVC Plastic Pipe Requirements

- a. Pipe less than 100 mm diameter: Threaded joints shall be made by wrapping the male threads with approved thread tape or applying an approved lubricant, then threading the joining members together. The joint shall be tightened using strap wrenches to prevent damage to the pipe and/or fitting. To avoid excessive torque, joints shall be tightened no more than one thread past hand-tight. Preformed rubber-ring gaskets for elastomeric-gasket joints shall be made in accordance with ASTM F 477 and as specified. Pipe ends for push-on joints shall be beveled to facilitate assembly and marked to indicate when the pipe is fully seated. The gasket shall be prelubricated to prevent displacement. The gasket and ring groove in the bell or coupling shall match. The manufacturer of the pipe or fitting shall supply the elastomeric gasket. Couplings shall be provided with stops or centering rings to assure that the coupling is centered on the joint. Solvent cement joints shall use sockets conforming to ASTM D 2467. The solvent cement used shall meet the requirements of ASTM D 2564; the joint assembly shall be made in accordance with ASTM D 2855 and the manufacturer's specific recommendations.
- b. Pipe 100 through 300 mm diameter: Joints shall be elastomeric gasket as specified in AWWA C900. Jointing procedure shall be as specified for pipe less than 100 mm diameter with configuration using elastomeric ring gasket.

##### 3.1.5.3 Ductile-Iron Pipe Requirements

Mechanical and push-on type joints shall be installed in accordance with AWWA C600 for buried lines or AWWA C606 for grooved and shouldered pipe above ground or in pits.

##### 3.1.5.4 Not Galvanized Steel Pipe Requirements

- a. Mechanical Couplings: Mechanical couplings shall be installed in accordance with the recommendations of the couplings manufacturer.
- b. Rubber Gaskets: Rubber gaskets shall be handled, lubricated where necessary, and installed in accordance with the pipe manufacturer's

recommendations.

#### 3.1.5.5 Copper Tubing Requirements

Joints shall be made with flared fittings. The flared end tube shall be pulled tightly against the tapered part of the fitting by a nut which is part of the fitting, so there is metal-to-metal contact.

#### 3.1.5.6 Bonded Joints Requirements

Bonded joints shall be installed in accordance with details specified for joints in paragraph JOINTS.

#### 3.1.5.7 Isolation Joints and Dielectric Fittings

Isolation joints and dielectric fittings shall be installed in accordance with details specified in paragraph JOINTS. Dielectric unions shall be encapsulated in a field-poured coal-tar covering, with at least 3 mm thickness of coal tar over all fitting surfaces.

#### 3.1.5.8 Transition Fittings

Connections between different types of pipe and accessories shall be made with transition fittings approved by the Contracting Officer.

#### 3.1.6 Installation of Service Lines

Service lines shall include the pipeline connecting building piping to water distribution lines to the connections with the building service at a point approximately 1.5 m outside the building where such building service exists.

Where building services are not installed, the Contractor shall terminate the service lines approximately 1.5 m from the site of the proposed building at a point designated by the Contracting Officer. Such service lines shall be closed with plugs or caps. All service stops and valves shall be provided with service boxes. Service lines shall be constructed in accordance with the following requirements:

##### 3.1.6.1 Service Lines Larger than 50 mm

Service lines larger than 50 mm shall be connected to the main by a tapped saddle, tapping sleeve and valve, service clamp or reducing tee, depending on the main diameter and the service line diameter, and shall have a gate valve. Lines 80 mm and larger may use rubber-seated butterfly valves as specified above, or gate valves.

##### 3.1.6.2 Service Lines for Sprinkler Supplies

Water service lines used to supply building sprinkler systems for fire protection shall be connected to the water distribution main in accordance with NFPA 24.

#### 3.1.7 Setting of Fire Hydrants, Meters, Valves and Valve Boxes

##### 3.1.7.1 Location of Fire Hydrants



Fire hydrants shall be located and installed as shown. Each hydrant shall be connected to the main with a 150 mm branch line having at least as much cover as the distribution main. Hydrants shall be set plumb with pumper nozzle facing the roadway, with the center of the lowest outlet not less than 450 mm above the finished surrounding grade, and the operating nut not more than 1.2 m above the finished surrounding grade. Except where approved otherwise, the backfill around hydrants shall be thoroughly compacted to the finished grade immediately after installation to obtain beneficial use of the hydrant as soon as practicable. The hydrant shall be set upon a slab of concrete not less than 100 mm thick and 400 mm square. Not less than 2 cubic meters of free-draining broken stone or gravel shall be placed around and beneath the waste opening of dry barrel hydrants to ensure drainage.

#### 3.1.7.2 Location of Meters

Meters and meter boxes Vaults shall be installed at the locations shown on the drawings. The meters shall be centered in the boxes vaults to allow for reading and ease of removal or maintenance.

#### 3.1.7.3 Location of Valves

After delivery, valves, including those in hydrants, shall be drained to prevent freezing and shall have the interiors cleaned of all foreign matter before installation. Stuffing boxes shall be tightened and hydrants and valves shall be fully opened and fully closed to ensure that all parts are in working condition. Check, pressure reducing, vacuum, and air relief valves shall be installed in valve pits. Valves and valve boxes shall be installed where shown or specified, and shall be set plumb. Valve boxes shall be centered on the valves. Boxes shall be installed over each outside gate valve unless otherwise shown. Where feasible, valves shall be located outside the area of roads and streets. Earth fill shall be tamped around each valve box or pit to a distance of 1.2 m on all sides of the box, or the undisturbed trench face if less than 1.2 m.

#### 3.1.7.4 Location of Service Boxes

Where water lines are located below paved streets having curbs, the boxes shall be installed directly back of the curbs. Where no curbing exists, service boxes shall be installed in accessible locations, beyond the limits of street surfacing, walks and driveways.

#### 3.1.8 Tapped Tees and Crosses

Tapped tees and crosses for future connections shall be installed where shown.

#### 3.1.9 Thrust Restraint

Plugs, caps, tees and bends deflecting 11.25 degrees or more, either vertically or horizontally, on waterlines 100 mm in diameter or larger, and fire hydrants shall be provided with thrust restraints. Valves shall be securely anchored or shall be provided with thrust restraints to prevent movement. Thrust restraints shall be either thrust blocks or, for

ductile-iron pipes, restrained joints.

#### 3.1.9.1 Thrust Blocks

Thrust blocking shall be concrete of a mix not leaner than: 1 cement, 2-1/2 sand, 5 gravel; and having a compressive strength of not less than 14 MPa after 28 days. Blocking shall be placed between solid ground and the hydrant or fitting to be anchored. Unless otherwise indicated or directed, the base and thrust bearing sides of thrust blocks shall be poured directly against undisturbed earth. The sides of thrust blocks not subject to thrust may be poured against forms. The area of bearing shall be as shown or as directed. Blocking shall be placed so that the fitting joints will be accessible for repair. Steel rods and clamps, protected by galvanizing or by coating with bituminous paint, shall be used to anchor vertical down bends into gravity thrust blocks.

#### 3.1.9.2 Restrained Joints

For ductile-iron pipe, restrained joints shall be designed by the Contractor or the pipe manufacturer in accordance with DIPRA-Restraint Design.

### 3.2 HYDROSTATIC TESTS

Where any section of a water line is provided with concrete thrust blocking for fittings or hydrants, the hydrostatic tests shall not be made until at least 5 days after installation of the concrete thrust blocking, unless otherwise approved.

#### 3.2.1 Pressure Test

After the pipe is laid, the joints completed, fire hydrants permanently installed, and the trench partially backfilled leaving the joints exposed for examination, the newly laid piping or any valved section of piping shall, unless otherwise specified, be subjected for 1 hour to a hydrostatic pressure test of 1.38 MPa. Water supply lines designated on the drawings shall be subjected for 1 hour to a hydrostatic pressure test of 1.38 MPa. Each valve shall be opened and closed several times during the test. Exposed pipe, joints, fittings, hydrants, and valves shall be carefully examined during the partially open trench test. Joints showing visible leakage shall be replaced or remade as necessary. Cracked or defective pipe, joints, fittings, hydrants and valves discovered in consequence of this pressure test shall be removed and replaced with sound material, and the test shall be repeated until the test results are satisfactory. The requirement for the joints to remain exposed for the hydrostatic tests may be waived by the Contracting Officer when one or more of the following conditions is encountered:

- a. Wet or unstable soil conditions in the trench.
- b. Compliance would require maintaining barricades and walkways around and across an open trench in a heavily used area that would require continuous surveillance to assure safe conditions.
- c. Maintaining the trench in an open condition would delay completion

of the project.

The Contractor may request a waiver, setting forth in writing the reasons for the request and stating the alternative procedure proposed to comply with the required hydrostatic tests. Backfill placed prior to the tests shall be placed in accordance with the requirements of Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

### 3.2.2 Leakage Test

Leakage test shall be conducted after the pressure tests have been satisfactorily completed. The duration of each leakage test shall be at least 2 hours, and during the test the water line shall be subjected to not less than 1.38 MPa pressure. Leakage is defined as the quantity of water to be supplied into the newly laid pipe, or any valved or approved section, necessary to maintain pressure within 34.5 kPa of the specified leakage test pressure after the pipe has been filled with water and the air expelled. Piping installation will not be accepted if leakage exceeds the allowable leakage which is determined by the following formula:

$$L = 0.0001351ND(P \text{ raised to } 0.5 \text{ power})$$

L = Allowable leakage in gallons per hour

N = Number of joints in the length of pipeline tested

D = Nominal diameter of the pipe in inches

P = Average test pressure during the leakage test, in psi gauge

Should any test of pipe disclose leakage greater than that calculated by the above formula, the defective joints shall be located and repaired until the leakage is within the specified allowance, without additional cost to the Government.

### 3.2.3 Time for Making Test

Except for joint material setting or where concrete thrust blocks necessitate a 5-day delay, pipelines jointed with rubber gaskets, mechanical or push-on joints, or couplings may be subjected to hydrostatic pressure, inspected, and tested for leakage at any time after partial completion of backfill. Cement-mortar lined pipe may be filled with water as recommended by the manufacturer before being subjected to the pressure test and subsequent leakage test.

### 3.2.4 Concurrent Hydrostatic Tests

The Contractor may elect to conduct the hydrostatic tests using either or both of the following procedures. Regardless of the sequence of tests employed, the results of pressure tests, leakage tests, and disinfection shall be as specified. Replacement, repair or retesting required shall be accomplished by the Contractor at no additional cost to the Government.

- a. Pressure test and leakage test may be conducted concurrently.
- b. Hydrostatic tests and disinfection may be conducted concurrently, using the water treated for disinfection to accomplish the

hydrostatic tests. If water is lost when treated for disinfection and air is admitted to the unit being tested, or if any repair procedure results in contamination of the unit, disinfection shall be reaccomplished.

### 3.3 BACTERIALDISINFECTION

#### 3.3.1 Bacteriological Disinfection

Before acceptance of potable water operation, each unit of completed waterline shall be disinfected, as specified. After pressure tests have been made, the unit to be disinfected shall be thoroughly flushed with water until all entrained dirt and mud have been removed before introducing the chlorinating material. The chlorinating material shall be either liquid chlorine, calcium hypochlorite, or sodium hypochlorite, conforming to paragraph MISCELLANEOUS ITEMS. The chlorinating material shall provide a dosage of not less than 50 ppm and shall be introduced into the water lines in an approved manner. Polyvinyl Chloride (PVC) pipe lines shall be chlorinated using only the above specified chlorinating material in solution. The agent shall not be introduced into the line in a dry solid state. The treated water shall be retained in the pipe long enough to destroy all non-spore forming bacteria. Except where a shorter period is approved, the retention time shall be at least 24 hours and shall produce not less than 25 ppm of free chlorine residual throughout the line at the end of the retention period. Valves on the lines being disinfected shall be opened and closed several times during the contact period. The line shall then be flushed with clean water until the residual chlorine is reduced to less than 1.0 ppm. During the flushing period, each fire hydrant on the line shall be opened and closed several times. From several points in the unit, personnel from the Contractor's commercial laboratory shall take at least 3 water samples from different points, approved by the Contracting Officer, in proper sterilized containers and perform a bacterial examination in accordance with state approved methods. The commercial laboratory shall be certified by the state's approving authority for examination of potable water. The disinfection shall be repeated until tests indicate the absence of pollution for at least 2 full days. The unit will not be accepted until satisfactory bacteriological results have been obtained.

### 3.4 CLEANUP

Upon completion of the installation of water lines, and appurtenances, all debris and surplus materials resulting from the work shall be removed.

-- End of Section --

## SECTION 02531

## SANITARY SEWERS

05/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN RAILWAY ENGINEERING &amp; MAINTENANCE-OF-WAY ASSOCIATION (AREMA)

AREMA Manual (1999) Manual for Railway Engineering (4 Vol.)

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 74 (1998) Cast Iron Soil Pipe and Fittings

ASTM A 123/A 123M (1997a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM C 14M (1995) Concrete Sewer, Storm Drain, and Culvert Pipe (Metric)

ASTM C 33 (1993) Concrete Aggregates

ASTM C 94 (1998) Ready-Mixed Concrete

ASTM C 270 (1997a) Mortar for Unit Masonry

ASTM C 425 (1998) Compression Joints for Vitrified Clay Pipe and Fittings

ASTM C 478M (1997) Precast Reinforced Concrete Manhole Sections (Metric)

ASTM C 564 (1997) Rubber Gaskets for Cast Iron Soil Pipe and Fittings

ASTM C 828 (1998) Low-Pressure Air Test of Vitrified Clay Pipe Lines

ASTM C 924 (1989; R 1997) Concrete Pipe Sewer Lines by Low-Pressure Air Test Method

ASTM C 972 (1995) Compression-Recovery of Tape Sealant

ASTM D 412 (1998a) Vulcanized Rubber and Thermoplastic

## Rubbers and Thermoplastic Elastomers - Tension

ASTM D 624	(1991; R 1998) Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
ASTM D 1784	(1999) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2680	(1995a) Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping
ASTM D 2751	(1996a) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 3034	(1998) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM F 402	(1993) Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F 949	(1996a) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

## AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C105	(1993) Polyethylene Encasement for Ductile-Iron Pipe Systems
AWWA C110	(1993) Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids
AWWA C111	(1995) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C115	(1996) Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges
AWWA C151	(1996) Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 49	(1994) Hazardous Chemicals Data
NFPA 325-1	(1994) Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids

NFPA 704 (1996) Identification of the Fire Hazards of Materials for Emergency Response

UNI-BELL PVC PIPE ASSOCIATION (UBPPA)

UBPPA UNI-B-6 (1990) Recommended Practice for the Low-Pressure Air Testing of Installed Sewer Pipe

UBPPA UNI-B-9 (1990; Addenda 1994) Recommended Performance Specification for Polyvinyl Chloride (PVC) Profile Wall Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter (Nominal Pipe Sizes 4-48 inch)

## 1.2 GENERAL REQUIREMENTS

The construction required herein shall include appurtenant structures and building sewers to points of connection with the building drains 1.5 m outside the building to which the sewer system is to be connected. The Contractor shall replace damaged material and redo unacceptable work at no additional cost to the Government. Excavation and backfilling is specified in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS. Backfilling shall be accomplished after inspection by the Contracting Officer. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install the plastic pipe shall be stored in accordance with the manufacturer's recommendation and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

SD-07 Certificates

Portland Cement

Certificates of compliance stating the type of cement used in manufacture of concrete pipe, fittings and precast manholes.

## PART 2 PRODUCTS

### 2.1 PIPE

Pipe shall conform to the respective specifications and other requirements specified below.

#### 2.1.1 Plastic Pipe

Acrylonitrile-butadiene-styrene (ABS) and polyvinyl chloride (PVC) composite sewer piping shall conform to ASTM D 2680. Size 200 mm through 380 mm diameter.

##### 2.1.1.1 ABS Pipe

ASTM D 2751.

##### 2.1.1.2 PVC Pipe

ASTM D 3034, Type PSM with a maximum SDR of 35, Size 380 mm or less in diameter. ASTM F 949 for corrugated sewer pipes with a smooth interior. UBPPA UNI-B-9 and ASTM F 794, Series 46, for ribbed sewer pipe with smooth interior, size 200 mm through 1200 mm diameters. PVC shall be certified by the compounder as meeting the requirements of ASTM D 1784, cell Class 12454B. The pipe stiffness shall be greater than or equal to 735/D for cohesionless material pipe trench backfills.

#### 2.1.2 Ductile Iron Pipe

Pipe shall conform to AWWA C151 unless otherwise shown or specified.

#### 2.1.3 Cast Iron Soil Pipe

Cast iron soil pipe shall conform to ASTM A 74, Class SV, except. When installed underground, pipe shall be encased with 2 mm thick polyethylene in accordance with AWWA C105.

### 2.2 REQUIREMENTS FOR FITTINGS

Fittings shall be compatible with the pipe supplied and shall have a strength not less than that of the pipe. Fittings shall conform to the respective specifications and other requirements specified below.

#### 2.2.1 Fittings for Plastic Pipe

ABS and PVC composite sewer pipe fittings shall conform to ASTM D 2680.

##### 2.2.1.1 Fittings for ABS Pipe

ASTM D 2751.



#### 2.2.1.2 Fittings for PVC Pipe

ASTM D 3034 for type PSM pipe. ASTM F 949 for corrugated sewer pipe with a smooth interior. UBPPA UNI-B-9 and ASTM F 794, Series 46, for ribbed sewer pipe with smooth interior.

#### 2.2.2 Fittings for RTRP

ASTM D 3262.

#### 2.2.3 Fittings for Ductile Iron Pipe

Mechanical fittings shall conform to AWWA C110, rated for 1.03 MPa. Push-on fittings shall conform to AWWA C110 and AWWA C111, rated for 10.3 MPa.

#### 2.2.4 Fittings for Cast Iron Soil Pipe

ASTM A 74.

#### 2.2.5 Fittings for Clay Pipe

ASTM C 700 Extra strength Acid resistant.

### 2.3 JOINTS

Joints installation shall comply with the manufacturer's instructions.

#### 2.3.1 Plastic Pipe Jointing

Flexible plastic pipe (PVC or high density polyethylene pipe) gasketed joints shall conform to ASTM D 3212.

##### 2.3.1.1 ABS Pipe Jointing

ASTM D 2751, solvent weld or bell and spigot O-ring joint, size 300 mm or less in diameter, dimensions and tolerances in accordance with Table 2 of ASTM D 2751.

##### 2.3.2 Ductile Iron Pipe Jointing

Push-on joints shall conform to AWWA C111. Mechanical joints shall conform to AWWA C111 as modified by AWWA C151. Flanged joints shall conform to AWWA C115.

##### 2.3.3 Cast Iron Soil Pipe Jointing

Rubber gaskets for compression joints shall conform to ASTM C 564. Packing material for caulked joints shall be twisted jute or oakum, tarred type, or asphalt-saturated cellulose-fiber. Joints for acid resisting cast iron soil pipe shall be made with acid resistant non-asbestos packing. The packing shall not contain material which would affect adhesion of the joint sealing material to the pipe. Lead shall be suitable for caulking of joints.

## 2.4 BRANCH CONNECTIONS

Branch connections shall be made by use of regular fittings or solvent cemented saddles as approved. Saddles for ABS and PVC composite pipe shall conform to Figure 2 of ASTM D 2680; saddles for ABS pipe shall comply with Table 3 of ASTM D 2751; and saddles for PVC pipe shall conform to Table 4 of ASTM D 3034.

## 2.5 FRAMES AND COVERS

Frames and covers shall be cast iron, ductile iron or reinforced concrete. Cast iron frames and covers shall be as indicated or shall be of type suitable for the application, circular, without vent holes. The frames and covers shall have a combined weight of not less than 181.4 kg. Reinforced concrete frames and covers shall be as indicated or shall conform to ASTM C 478 or ASTM C 478M. The word "Sewer" shall be stamped or cast into covers so that it is plainly visible.

## 2.6 STEEL LADDER

A steel ladder shall be provided where the depth of a manhole exceeds 3.6 m. The ladder shall not be less than 406 mm (16 in) width, with 19 mm diameter rungs spaced 305 mm apart. The two stringers shall be a minimum 10 mm thick and 51 mm wide. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A 123/A 123M.

## 2.7 CEMENT MORTAR

Cement mortar shall conform to ASTM C 270, Type M with Type II cement.

### 2.7.1 Portland Cement

Portland cement shall conform to ASTM C 150, Type II V for concrete used in concrete pipe, concrete pipe fittings, and manholes and type optional with the Contractor for cement used in concrete cradle, concrete encasement, and thrust blocking. Air-entraining admixture conforming to ASTM C 260 shall be used with Type V cement. Where aggregates are alkali reactive, as determined by Appendix XI of ASTM C 33, a cement containing less than 0.60 percent alkalis shall be used.

### 2.7.2 Portland Cement Concrete

Portland cement concrete shall conform to ASTM C 94, compressive strength of 28 MPa at 28 days, except for concrete cradle and encasement or concrete blocks for manholes. Concrete used for cradle and encasement shall have a compressive strength of 17 MPa minimum at 28 days. Concrete in place shall be protected from freezing and moisture loss for 7 days.

## 2.8 STRUCTURES

### 2.8.1 Precast Reinforced Concrete Manhole Sections

Precast reinforced concrete manhole sections shall conform to ASTM C 478, except that portland cement shall be as specified herein. Joints shall be

cement mortar, an approved mastic, rubber gaskets, a combination of these types; or the use of external preformed rubber joint seals and extruded rolls of rubber with mastic adhesive on one side.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Adjacent Facilities

###### 3.1.1.1 Water Lines

Where the location of the sewer is not clearly defined by dimensions on the drawings, the sewer shall not be closer horizontally than 3 m to a water-supply main or service line, except that where the bottom of the water pipe will be at least 300 mm above the top of the sewer pipe, the horizontal spacing may be a minimum of 2 m. Where gravity-flow sewers cross above water lines, the sewer pipe for a distance of 3 m on each side of the crossing shall be fully encased in concrete or shall be acceptable pressure pipe with no joint closer horizontally than 1 m to the crossing. The thickness of the concrete encasement including that at the pipe joints shall be not less than 100 mm.

###### 3.1.1.2 Road Crossings

Water pipe shall be encased in a sleeve of rigid conduit for the lengths shown. Where sleeves are required, in all other cases, the pipe sleeve shall be as specified for storm drains in Section 02630 STORM-DRAINAGE SYSTEM. A minimum clearance of at least 50 mm between the inner wall of the sleeve and the maximum outside diameter of the sleeved pipe and joints shall be provided. Sand bedding shall be provided for the water pipe through the sleeve. Sleeves of ferrous material shall be provided with the corrosion protection as required for the conditions encountered at the site of installation.

###### 3.1.1.3 Structural Foundations

Where sewer pipe is to be installed within 1 m of an existing or proposed building or structural foundation such as a retaining wall, control tower footing, water tank footing, or any similar structure, the sewer pipe shall be sleeved as specified above. Contractor shall ensure there is no damage to these structures, and no settlement or movement of foundations or footing.

##### 3.1.2 Pipe Laying

- a. Pipe shall be protected during handling against impact shocks and free fall; the pipe interior shall be free of extraneous material.
- b. Pipe laying shall proceed upgrade with the spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow. Each pipe shall be laid accurately to the line and grade shown on the drawings. Pipe shall be laid and centered so that the sewer has a uniform invert. As the work progresses, the interior of the sewer shall be cleared of all

superfluous materials.

- c. Before making pipe joints, all surfaces of the portions of the pipe to be joined shall be clean and dry. Lubricants, primers, and adhesives shall be used as recommended by the pipe manufacturer. The joints shall then be placed, fitted, joined, and adjusted to obtain the degree of water tightness required.
- d. ABS composite pipe ends with exposed truss and filler material shall be coated with solvent weld material before making the joint to prevent water or air passage at the joint between the inner and outer wall of the pipe.
- e. Installations of solvent weld joint pipe, using ABS or PVC pipe and fittings shall be in accordance with ASTM F 402. The Contractor shall ensure adequate trench ventilation and protection for workers installing the pipe.

#### 3.1.2.1 Caulked Joints

The packing material shall be well packed into the annular space to prevent the entrance of lead into the pipe. The remainder of the space shall be filled with molten lead that is hot enough to show a rapid change in color when stirred. Scum shall be removed before pouring. The lead shall be caulked to form a tight joint without overstraining the bell and shall have a minimum depth of 25 mm after caulking.

#### 3.1.2.2 Trenches

Trenches shall be kept free of water and as dry as possible during bedding, laying, and jointing and for as long a period as required. When work is not in progress, open ends of pipe and fittings shall be satisfactorily closed so that no trench water or other material will enter the pipe or fittings.

#### 3.1.2.3 Backfill

As soon as possible after the joint is made, sufficient backfill material shall be placed along the pipe to prevent pipe movement off line or grade. Plastic pipe shall be completely covered to prevent damage from ultraviolet light.

#### 3.1.2.4 Width of Trench

If the maximum width of the trench at the top of the pipe, as specified in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS, is exceeded for any reason other than by direction, the Contractor shall install, at no additional cost to the Government, concrete cradling, pipe encasement, or other bedding required to support the added load of the backfill.

#### 3.1.2.5 Jointing

Joints between different pipe materials shall be made as specified, using approved jointing materials.

### 3.1.2.6 Handling and Storage

Pipe, fittings and joint material shall be handled and stored in accordance with the manufacturer's recommendations. Storage facilities for plastic pipe, fittings, joint materials and solvents shall be classified and marked in accordance with NFPA 704, with classification as indicated in NFPA 49 and NFPA 325-1.

### 3.1.3 Leakage Tests

Lines shall be tested for leakage by low pressure air testing, infiltration tests or exfiltration tests, as appropriate. Low pressure air testing for PVC pipe shall be as prescribed in UBPPA UNI-B-6. Low pressure air testing procedures for other pipe materials shall use the pressures and testing times prescribed in ASTM C 828 and ASTM C 924, after consultation with the pipe manufacturer. Prior to infiltration or exfiltration tests, the trench shall be backfilled up to at least the lower half of the pipe. If required, sufficient additional backfill shall be placed to prevent pipe movement during testing, leaving the joints uncovered to permit inspection. Visible leaks encountered shall be corrected regardless of leakage test results. When the water table is 600 mm or more above the top of the pipe at the upper end of the pipeline section to be tested, infiltration shall be measured using a suitable weir or other device acceptable to the Contracting Officer. When the Contracting Officer determines that infiltration cannot be properly tested, an exfiltration test shall be made by filling the line to be tested with water so that a head of at least 600 mm is provided above both the water table and the top of the pipe at the upper end of the pipeline to be tested. The filled line shall be allowed to stand until the pipe has reached its maximum absorption, but not less than 4 hours. After absorption, the head shall be re-established. The amount of water required to maintain this water level during a 2-hour test period shall be measured. Leakage as measured by either the infiltration test or exfiltration test shall not exceed 94 L per 1 mm diameter per km of pipeline per day. When leakage exceeds the maximum amount specified, satisfactory correction shall be made and retesting accomplished. Testing, correction, and retesting shall be made at no additional cost to the Government.

### 3.1.4 Test for Deflection

When flexible pipe is used, a deflection test shall be made on the entire length of the installed pipeline not less than 30 days after the completion of all work including the leakage test, backfill, and placement of any fill, grading, paving, concrete, or superimposed loads. Deflection shall be determined by use of a deflection device or by use of a spherical, spheroidal, or elliptical ball, a cylinder, or circular sections fused to a common shaft. The ball, cylinder, or circular sections shall have a diameter, or minor diameter as applicable, of 92.5 percent of the inside diameter of the pipe. A tolerance of plus 0.5 percent will be permitted. The ball, cylinder, or circular sections shall be of a homogeneous material throughout, shall have a density greater than 1.0 as related to water at 4.0 degrees C, and shall have a surface brinell hardness of not less than 150. The device shall be center bored and through bolted with a 6 mm minimum diameter steel shaft having a yield strength of 480 MPa or more, with eyes

at each end for attaching pulling cables. The eye shall be suitably backed with flange or heavy washer; a pull exerted on the opposite end of the shaft shall produce compression throughout the remote end of the ball, cylinder or circular section. Circular sections shall be spaced so that the distance from the external faces of the front and back sections shall equal or exceed the diameter of the circular section. Failure of the ball, cylinder, or circular section to pass freely through a pipe run, either by being pulled through or by being flushed through with water, shall be cause for rejection of that run. When a deflection device is used for the test in lieu of the ball, cylinder, or circular sections described, such device shall be approved prior to use. The device shall be sensitive to 1.0 percent of the diameter of the pipe being measured and shall be accurate to 1.0 percent of the indicated dimension. Installed pipe showing deflections greater than 7.5 percent of the normal diameter of the pipe, shall be retested by a run from the opposite direction. If the retest also fails, the suspect pipe shall be replaced at no cost to the Government.

### 3.2 CONCRETE CRADLE AND ENCASEMENT

The pipe shall be supported on a concrete cradle, or encased in concrete where indicated or directed.

### 3.3 INSTALLATION OF WYE BRANCHES

Wye branches shall be installed where sewer connections are indicated or where directed. Cutting into piping for connections shall not be done except in special approved cases. When the connecting pipe cannot be adequately supported on undisturbed earth or tamped backfill, the pipe shall be encased in concrete backfill or supported on a concrete cradle as directed. Concrete required because of conditions resulting from faulty construction methods or negligence by the Contractor shall be installed at no additional cost to the Government. The installation of wye branches in an existing sewer shall be made by a method which does not damage the integrity of the existing sewer. One acceptable method consists of removing one pipe section, breaking off the upper half of the bell of the next lower section and half of the running bell of wye section. After placing the new section, it shall be rotated so that the broken half of the bell will be at the bottom. The two joints shall then be made with joint packing and cement mortar.

### 3.4 MANHOLE DETAILS

#### 3.4.1 General Requirements

Manholes shall be constructed of concrete, or precast concrete manhole sections. The invert channels shall be smooth and semicircular in shape conforming to the inside of the adjacent sewer section. Changes in direction of flow shall be made with a smooth curve of as large a radius as the size of the manhole will permit. Changes in size and grade of the channels shall be made gradually and evenly. The invert channels shall be formed directly in the concrete of the manhole base, or shall be built up with brick and mortar, or shall be half tile laid in concrete, or shall be constructed by laying full section sewer pipe through the manhole and breaking out the top half after the surrounding concrete has hardened. Pipe

connections shall be made to manhole using water stops, standard O-ring joints, special manhole coupling, or shall be made in accordance with the manufacturer's recommendation. The Contractor's proposed method of connection, list of materials selected, and specials required, shall be approved prior to installation. The floor of the manhole outside the channels shall be smooth and shall slope toward the channels not less than 100 mm per meter nor more than 200 mm per meter. Free drop inside the manholes shall not exceed 500 mm, measured from the invert of the inlet pipe to the top of the floor of the manhole outside the channels; drop manholes shall be constructed whenever the free drop would otherwise be greater than 500 mm.

#### 3.4.2 Steel Ladder Anchorage

Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 1850 mm apart vertically, and shall be installed to provide at least 150 mm of space between the wall and the rungs. The wall along the line of the ladder shall be vertical for its entire length.

#### 3.4.3 Jointing, Plastering and Sealing

Mortar joints shall be completely filled and shall be smooth and free from surplus mortar on the inside of the manhole. Mortar and mastic joints between precast rings shall be full-bedded in jointing compound and shall be smoothed to a uniform surface on both the interior and exterior of the manhole. Installation of rubber gasket joints between precast rings shall be in accordance with the recommendations of the manufacturer. Precast rings may also be sealed by the use of extruded rolls of rubber with mastic adhesive on one side.

#### 3.4.4 Setting of Frames and Covers

Unless otherwise indicated, tops of frames and covers shall be set flush with finished grade in paved areas or 50 mm higher than finished grade in unpaved areas. Frame and cover assemblies shall be sealed to manhole sections using external preformed rubber joint seals that meet the requirements of ASTM D 412 and ASTM D 624, or other methods specified in paragraph Jointing, Plastering and Sealing, unless otherwise specified.

#### 3.4.5 External Preformed Rubber Joint Seals

External preformed rubber joint seals and extruded rolls of rubber with mastic adhesive shall meet the requirements of ASTM D 412 and ASTM C 972 to ensure conformance with paragraph Leakage Tests. The seal shall be multi-section with neoprene rubber top section and all lower sections made of Ethylene Propylene Di Monomer (EPDM) rubber with a minimum thickness of 1.5 mm. Each unit shall consist of a top and a bottom section and shall have mastic on the bottom of the bottom section and mastic on the top and bottom of the top section. The mastic shall be non-hardening butyl rubber sealant and shall seal to the cone/top slab of the manhole/catch basin and over the lip of the casting. One unit shall seal a casting and up to six, 50 mm adjusting rings. The bottom section shall be 305 mm in height. A 152 mm high top section will cover up to two, 50 mm adjusting rings. A 305 mm high bottom section will cover up to six, 50 mm adjusting rings. Extension

sections shall cover up to two more adjusting rings. Each extension shall overlap the bottom section by 50 mm and shall be overlapped by the top section by 50 mm.

### 3.5 CONNECTING TO EXISTING MANHOLES

Pipe connections to existing manholes shall be made so that finish work will conform as nearly as practicable to the applicable requirements specified for new manholes, including all necessary concrete work, cutting, and shaping. The connection shall be centered on the manhole. Holes for the new pipe shall be of sufficient diameter to allow packing cement mortar around the entire periphery of the pipe but no larger than 1.5 times the diameter of the pipe. Cutting the manhole shall be done in a manner that will cause the least damage to the walls.

### 3.6 BUILDING CONNECTIONS

Building connections shall include the lines to and connection with the building waste drainage piping at a point approximately 1.5 m outside the building, unless otherwise indicated. Where building drain piping is not installed, the Contractor shall terminate the building connections approximately 1.5 m from the site of the building at a point and in a manner designated.

### 3.7 CLEANOUTS AND OTHER APPURTENANCES

Cleanouts and other appurtenances shall be installed where shown on the drawings or as directed by the Contracting Officer, and shall conform to the detail of the drawings.

-- End of Section --



## SECTION 02555

PREFABRICATED UNDERGROUND HEATING/COOLING DISTRIBUTION SYSTEM  
12/97

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53	(1998) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
ASTM A 105/A 105M	(1998) Carbon Steel Forgings for Piping Applications
ASTM A 106	(1997a) Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 234/A 234M	(1997) Piping Fittings of Wrought Carbon Steel for Moderate and High Temperature Service
ASTM B 88	(1996) Seamless Copper Water Tube
ASTM C 518	(1991) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
ASTM C 591	(1994) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM D 1248	(1984; R 1989) Polyethylene Plastics Molding and Extrusion Materials
ASTM D 1384	(1997a) Corrosion Test for Engine Coolants in Glassware
ASTM D 1784	(1996) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2241	(1996b) Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D 2564	(1996a) Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

ASTM D 3139	(1998) Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D 5686	(1995) "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Pipe Fittings, Adhesive Bonded Joint Type Epoxy Resin, for Condensate Return Lines
ASTM F 477	(1996) Elastomeric Seals (Gaskets) for Joining Plastic Pipe

#### AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1996) Forged Fittings, Socket-Welding and Threaded
ASME B31.1	(1998) Power Piping
ASME BPV IX	(1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

#### COPPER DEVELOPMENT ASSOCIATION (CDA)

CDA Tube Handbook	(1995) Copper Tube Handbook
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#### MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-73	(1991; R 1996) Brazing Joints for Copper and Copper Alloy Pressure Fittings
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### 1.2 SYSTEM DESCRIPTION

The system consists of a buried prefabricated chilled water distribution system including service connections to a point 150 mm inside of the building. The contract drawings show the specific arrangement of piping, sizes and grades of pipe, and other details. The system is designed for an operating pressure of 1034 kPa and an operating temperature of 5.6 degrees C for chilled water.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete

system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-02 Shop Drawings

Distribution System; GA-AO.

Detail drawings consisting of fabrication and assembly drawings, for all parts of the work in sufficient detail to check conformity with the requirements of the contract documents, prior to installation. Detail drawings shall also contain complete piping, wiring and schematic diagrams and any other details to demonstrate that the system has been coordinated and will properly function as a unit. Drawings shall show proposed layout, method of compensation for pipe expansion and contraction, anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances required for maintenance and operation. The drawings shall clearly identify any proposed deviations from the requirements of the contract documents.

#### SD-03 Product Data

Distribution System; GA-AO.

Data composed of catalog cuts, brochures, circulars, specifications and product data, and printed information in sufficient detail and scope to verify compliance with the requirements of the contract documents.

#### SD-07 Certificates

Distribution System

The manufacturer's or system fabricator's written certification stating that the distribution system furnished meets all the requirements of this specification.

#### Welding Procedures and Operators

Prior to welding operations, a copy of qualified procedures and a list of names and identification symbols of qualified welders and welding operators.

#### SD-10 Operation and Maintenance Data

Distribution System; GA-AO.

Six copies of operation and 6 copies of maintenance manuals for the equipment furnished, 1 complete set prior to performance testing and the remainder upon acceptance. Operation manuals shall detail the step-by-step procedures required for equipment startup, operation, and shutdown. Operation manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features.

Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout and simplified wiring and control diagrams of the equipment system as installed. Manuals shall be approved prior to the field performance testing.

#### 1.4 DELIVERY AND STORAGE

After delivery to the jobsite, all materials and equipment shall be protected from anything which could cause damage to the material or equipment. Pipe shall be sealed at each end to keep the interior clean and free of dirt and debris. Fittings shall be kept together and their interior surfaces shall remain clean. Insulation shall be kept dry and clean.

#### 1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field and shall advise the Contracting Officer of any discrepancy before performing the work.

#### 1.6 WELDING

[Piping shall be welded in accordance with qualified procedures using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests and the tests shall be performed at the work site if practicable. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record. Structural members shall be welded in accordance with Section 05090 WELDING, STRUCTURAL.

### PART 2 PRODUCTS

#### 2.1 STANDARD PRODUCTS

System components shall be standard products of a manufacturer regularly engaged in the manufacture of the product and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. The system shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

#### 2.2 PIPING AND CASING MATERIALS

##### 2.2.1 General

Metallic pressure pipe, fittings, and piping accessories shall conform to the requirements of ASME B31.1 and shall be types suitable for the temperature and pressure of the water.

##### 2.2.2 Piping

##### 2.2.2.1 Steel Pipe

Piping shall conform to ASTM A 53, Grade B, standard weight, black or to ASTM A 106, Grade B, standard weight.

#### 2.2.2.2 Copper Tubing

Copper tubing shall conform to ASTM B 88, Type K or L.

#### 2.2.2.3 Polyvinyl Chloride (PVC) Pipe

PVC pipe shall conform to ASTM D 2241 with a Standard Thermoplastic Pipe Dimension Ratio (SDR) of 26 and PVC 1120 or 1220 as the material.

#### 2.2.3 Casings

##### 2.2.3.1 Polyvinyl Chloride (PVC) Casing

PVC casings shall conform to ASTM D 1784, Class 12454-B with a minimum thickness equal to the greater of 1/100 the diameter of the casing or 1.50 mm.

#### 2.3 PIPING CONNECTIONS

##### 2.3.1 Steel Pipe

Steel pipe smaller than 20 mm (3/4 inch) may be threaded; otherwise, all steel pipe shall be welded. Steel welding fittings shall conform to the requirements of ASTM A 105/A 105M or ASTM A 234/A 234M. Welding fittings shall also conform to ASME B16.9 for butt-weld fittings and ASME B16.11 for socket-weld fittings. Long radius butt-welding elbows conforming to ASME B16.9 shall be used whenever space permits. Pipe Threads shall conform to ASME B1.20.1. Pipe to be threaded shall be schedule 80.

##### 2.3.2 Copper Pipe

Copper pipe shall be brazed or connected using an insulated pipe coupling. Wrought copper or cast copper alloy solder joint pressure fittings shall conform to MSS SP-73. Insulated pipe couplings for copper pipe shall be cast bronze containing an O-ring seal on each end and shall be jacketed and sealed to act as an expansion joint.

##### 2.3.3 Plastic Pipe

- a. Pipe, fittings, flanges, and couplings shall have end connections of the adhesive bell and spigot type. Threaded piping, including pipe, fittings, flanges, and couplings, will not be permitted.
- b. Flanged Connections: Flat face flanged connections shall be provided between plastic piping and metal piping. Plastic flanges shall be suitable for connection to ASME Class 150 flanges.
- c. RTRP Piping Sizes: When piping sizes other than 50, 75, 100, 150, and 200 mm are indicated, the next larger piping size shall be provided. The connecting system piping shall be of the same size or

increased to meet the next size of RTRP piping.

#### 2.3.3.1 General

Plastic fittings shall be made of the same type and grade of material as the piping to which they will be connected and shall be furnished by the manufacturer who supplies the pipe. Fittings shall have temperature and pressure ratings not less than those of the connecting piping.

#### 2.3.3.2 Polyvinyl Chloride (PVC)

Polyvinyl chloride (PVC) pipe shall be solvent welded or connected using bell and spigot connections. The solvent used to connect fittings and pipe shall conform to the requirements of ASTM D 2564. Bell and spigot joints utilizing elastomeric seals shall conform to the requirements of ASTM D 3139. The elastomeric seals shall conform to ASTM F 477.

### 2.4 END SEALS

#### 2.4.1 General

Each preinsulated section of piping shall have a complete sealing of the insulation to provide a permanent water and vapor seal at each end of the preinsulated section of piping. Preinsulated sections of piping modified in the field shall be provided with an end seal which is equivalent to the end seals furnished with the preinsulated section of piping. End seals must be tested and certified in accordance with paragraph Casing and End Seal Testing and Certification.

#### 2.4.2 Types

End seals provided shall be one of the following types:

- a. Carrying the outer casing over tapered pipe insulation ends and extending it to the carrier pipe. Sufficient surface bonding area shall be provided between the casing and the carrier pipe.
- b. Using specially designed molded caps made of polyethylene or rubber of standard manufactured thickness. A minimum 40 mm surface bonding area shall be provided between the cap and both the casing and carrier pipe.
- c. Using elastomer-ring end seals designed and dimensioned to fit in the annular space between the casing and the carrier pipe.
- d. Using a waterproof mastic seal vapor barrier over the exposed insulation ends.
- e. Shrink sleeves.

#### 2.4.3 Casing and End Seal Testing and Certification

Testing and certification procedures by an independent testing laboratory shall demonstrate that casings and end seals are capable of resisting

penetration of water into the casing and insulation. The test shall be performed on the type of prefabricated system to be furnished. If more than one type of prefabricated system is to be used, then the tests shall be performed on each type. The test shall consist of hot and cold cycle testing followed by immersion in a water filled chamber with a head pressure. The hot and cold cycle testing shall consist of 14 days of temperature cycling. A fluid with a temperature of 5 degrees C shall circulate through the carrier pipe alternating every 24-hours with a fluid with a temperature of 95 degrees C circulating through the carrier pipe for a low temperature hot water or dual temperature service or 24 degrees for a chilled water service. While the hot and cold cycle test is being performed, the test sample is either buried or encased in dry bedding sand with a minimum of 300 mm of sand all around the test sample. The carrier pipe size of the test sample shall be 80 mm (3 inches) in diameter and shall be restrained during the test period. The insulation thickness shall not exceed the maximum thickness provided for the piping in the project. Transition time for temperature cycle testing shall not exceed 15 minutes in going from cold to hot and 30 minutes in going from hot to cold. The fluid in the carrier pipe may be water, oil or heat transfer fluid. Following the hot and cold cycling test, the test sample shall be immersed in a water filled chamber. The pressure on the highest point of the test sample shall not be less than 60 kPa subjected over the entire length of the 2.4 m test sample of prefabricated pipe. The water shall contain a dye penetrant, which will be used to check for end seal leakage. The pressure in the chamber must be held for not less than 48 hours. Upon completion of this pressure test, the test sample shall be cut open. With the use of a light that will readily show the presence of the dye that was in the water, the test sample shall be inspected. Evidence of the dye inside the test sample shall indicate that the end seal is not acceptable and cannot be certified.

## 2.5 INSULATION

### 2.5.1 Factory Applied Insulation

Prefabricated pipe and fittings shall be insulated in the factory. Foam insulation for prefabricated insulated pipe and fittings shall be polyurethane foam meeting the requirements of ASTM C 591 having a density not less than 32 kg per cubic meter. The polyurethane foam shall completely fill the annular space between the carrier pipe and the casing. Insulation thickness shall be a minimum of 20 mm. The insulation thermal conductivity factor shall not exceed the numerical value of 0.02 W/mK at 24 degrees C, when tested in accordance with ASTM C 518. Manufacturer shall certify that the insulated pipe is free of insulation voids.

### 2.5.2 Field Applied Insulation

Field applied insulation for fittings, and field casing closures, if required, and other piping system accessories shall be polyurethane matching the pipe insulation. Thickness shall match adjacent piping insulation thickness. Buried fittings and accessories shall have field applied polyurethane insulation to match adjacent piping and shall be protected with a covering matching the pipe casing. Shrink sleeves with a minimum thickness of 1.3 mm shall be provided over casing connection joints.

## 2.6 CONCRETE VALVE MANHOLES

Concrete valve manholes shall be provided in accordance with Section 02570 VALVE MANHOLES AND PIPING AND EQUIPMENT IN VALVE MANHOLES.

## 2.7 PIPING AND EQUIPMENT IN VALVE MANHOLES

Piping and equipment in valve manholes shall be provided in accordance with Section 02570 VALVE MANHOLES AND PIPING AND EQUIPMENT IN VALVE MANHOLES.

## 2.8 TREATED WATER

A 35 percent concentration by volume of industrial grade propylene glycol shall be provided for the system. Glycol shall be tested in accordance with ASTM D 1384 with less than 0.013 mm penetration per year for all system metals. The glycol shall contain corrosion inhibitors. Silicate based inhibitors shall not be used. The solution shall be compatible with pump seals, other elements of the system, and water treatment chemicals used within the system.

# PART 3 EXECUTION

## 3.1 INSTALLATION

For all preinsulated, prefabricated systems, the Contractor shall obtain the services of a trained representative of the pipe system manufacturer to instruct the Contractor's work forces in the installation procedures to ensure that the system is installed in accordance with the manufacturer's published instructions and the plans and specifications. The manufacturer's representative shall be a person who regularly performs such duties for the manufacturer. The Contractor shall furnish the Contracting Officer a list of names of personnel trained and certified by the pipe system manufacturer in the installation of this system. Only personnel whose names appear on the list will be allowed to install the system. The list shall not be more than 1 year old.

## 3.2 PIPING SYSTEMS

### 3.2.1 Buried Insulated Systems

Buried insulated systems shall consist of carrier pipe, insulation, casing, end seals, fittings and accessories as specified.

### 3.2.2 Buried Uninsulated Systems

Buried uninsulated systems shall consist of carrier pipe, fittings and accessories as specified.

## 3.3 VALVE MANHOLES AND PIPING EQUIPMENT IN VALVE MANHOLES

Valve manholes and piping and equipment in valve manholes shall be installed in accordance with Section 02570 VALVE MANHOLES AND PIPING AND EQUIPMENT IN VALVE MANHOLES.



### 3.4 THRUST BLOCKS

Thrust blocks shall be installed at the locations shown or recommended by the pipe system manufacturer. Thrust blocks may not be required on all systems, and the need for thrust blocks shall be as recommended by the system manufacturer. Thrust blocks, if necessary, shall be installed at all changes in direction, changes in size, valves and terminal ends, such as plugs, caps and tees. Thrust blocks shall be concrete having a compressive strength of not less than 14 MPa (2000 psi) after 28 days and shall be in accordance with Section 03300CAST-IN-PLACE STRUCTURAL CONCRETE. Thrust blocks shall be placed between solid ground and the fitting to be anchored. Unless otherwise indicated or directed, the base and the thrust bearing sides of the thrust blocks shall be poured directly against undisturbed earth. The sides of the thrust blocks not subject to thrust may be poured against forms. Thrust blocks shall be placed so that the joints for all fittings will be accessible for repair wherever possible. No pipe joint shall be embedded in concrete unless the assembly has previously been hydrostatically tested. The thrust blocks shall provide for transfer of thrusts and reactions without exceeding the allowable stress of the concrete and shall be installed in accordance with pipe manufacturer's instructions. In muck or peat, all thrusts shall be resisted by piles or tie rods to solid foundations or by removal of peat or muck which shall be replaced with ballast of sufficient stability to resist thrusts.

### 3.5 INSTALLATION OF PIPING SYSTEMS

The piping system furnished shall be installed in accordance with the piping system manufacturer's instructions. Piping shall be installed without springing or forcing other than what has been calculated for cold spring. Pipe ends shall have burrs removed by reaming and shall be installed to permit free expansion and contraction without damage to joints or hangers. Nonmetallic pipe cut in the field shall be machined to fit couplings or joints and shall be coated or treated to match standard factory coated ends. Copper tubing shall not be installed in the same trench with ferrous piping materials. When nonferrous metallic pipe (e.g., copper tubing) crosses any ferrous piping material, a minimum vertical separation of 300 mm shall be maintained between pipes. Connections between different types of pipe and accessories shall be made with transition fittings approved by the manufacturer of the piping system.

#### 3.5.1 Pitching of Horizontal Piping

Horizontal piping shall be pitched at a grade of not less than 40 mm in 1 m toward the drain points unless otherwise indicated.

#### 3.5.2 Open Ends

Open ends of pipelines and equipment shall be properly capped or plugged during installation to keep dirt and other foreign matter out of the system.

#### 3.5.3 Cutting Prefabricated Piping Sections

Where prefabricated pipe sections are field cut, new end seals similar to the factory applied end seal shall be provided and installed in accordance

with the manufacturer's instructions.

#### 3.5.4 Joints

##### 3.5.4.1 Welded Joints

Welded joints between sections of pipe and between pipe and fittings shall be provided where specified or indicated.

##### 3.5.4.2 Threaded Joints

Threaded joints shall not be used belowground. Joints shall be made tight with polytetrafluoroethylene tape applied to the male threads only. Not more than 3 threads shall show after the joint is made up.

##### 3.5.4.3 Brazed Joints

Brazed joints for copper pipe and fittings shall conform to CDA Tube Handbook. Brazing alloys melting above 593.3 degrees C (1100 degrees F) shall be utilized.

##### 3.5.4.4 Nonmetallic Pipe Joints

Nonmetallic pipe joints shall be installed in accordance with the written instructions of the manufacturer.

#### 3.5.5 Expansion Loops

If expansion compensation is needed, expansion loops and expansion bends (Z- and L- type) shall be factory fabricated of casing, insulation, and carrier piping identical to that furnished for straight runs. Expansion loops and bends shall be properly designed in accordance with the allowable stress limits indicated in ASME B31.1 for the type of pipe used. Expansion loops and bends shall be shipped to the jobsite in the maximum size sections feasible to minimize the number of field joints. The expansion loops and bends casing and insulation where applicable, shall be suitably sized to accommodate pipe movement. Field joints shall be made in straight runs of the expansion loops and bends, and the number shall be kept to a minimum. For steel pipe, cold springing shall not be allowed when sizing the expansion loops and bends, but piping shall be cold sprung one-half the calculated maximum operational expansion during field assembly. Pipe stress in expansion loops and bends shall conform to the requirements for expansion loops specified in ASME B31.1.

#### 3.5.6 Anchors

Anchor design shall be in accordance with the published data of the manufacturer and for prefabricated systems shall be factory fabricated by the prefabricated system manufacturer. In all cases, the design shall be such that water penetration, condensation, or vapor transmission will not wet the insulation.

#### 3.5.7 Field Casing Closures

Field insulation and encasement of joints shall be accomplished after the visual and pressure tests specified are completed. Field insulation and encasement shall be in accordance with the manufacturer's written instructions. Thickness dimensions of the insulation and casing materials shall not be less than those of the adjoining prefabricated section. Insulating material shall be foamed in place polyurethane. Care should be taken to ensure that field closures are made under conditions of temperature and cleanliness required to produce a sound, continuous vapor barrier. A standard polyethylene heat shrink sleeve shall be installed over the casing and shall have a 150 mm minimum overlap at each end.

#### 3.5.8 Underground Warning Tape

Underground warning tape shall be buried above the piping during the trench backfilling and shall be buried approximately 300 mm deep. Tape shall be 0.1 mm thick polyethylene tape] [polyethylene tape with metallic core]. Tape shall be 150 mm wide and be printed with repetitive caution warnings along its length. Tapes shall be yellow in color with black letters. Tape color and lettering shall not be affected by moisture or other substances contained in the backfill material.

#### 3.5.9 Markers for Underground Piping

Markers for underground piping shall be placed as indicated approximately 600 mm to the right of the distribution system and referenced to the flow direction in the supply line. The marker shall be concrete 150 mm square or round section 600 mm long. The top edge of the marker shall have a minimum 10 mm chamfer all around. The letters [CHW] shall be impressed or cast on the top of the markers to indicate the type of system that is being identified. Each letter shall be formed with a V-shaped groove and shall have a width of stroke at least 6 mm at the top and depth of 6 mm. The top of the marker shall protrude not more than 100 mm above finished grade.

### 3.6 EARTHWORK

Earthwork shall be performed in accordance with Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

### 3.7 ELECTRICAL WORK

Electrical work shall be performed in accordance with either Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND or Section 16370 ELECTRICAL DISTRIBUTION SYSTEM, AERIAL.

### 3.8 TESTING

Tests shall be conducted before, during, and after installation of the system. All instruments, equipment, facilities, and labor required to properly conduct the tests shall be provided by the Contractor. Test pressure gauges for a specific test shall have dials indicating not less than 1-1/2 times nor more than 2 times the test pressure. It shall be the Contractor's responsibility to make the pipe system workable at his expense.

#### 3.8.1 Metallic Pipe Welds

An approved independent testing firm or firms regularly engaged in radiographic testing shall perform a radiographic examination of the field welds. The radiographic testing shall be performed in accordance with ASME B31.1. All radiographs shall be reviewed and interpreted by a Certified Level III Radiographer employed by the testing firm. Any welds found to be unacceptable shall be removed, rewelded and radiographically reexamined in accordance with the above criteria. Such repair and reexamination shall be accomplished at no cost to the Government.

### 3.8.2 Carrier Pipe Cleaning and Testing

Distribution piping shall be tested as required before backfilling and with all joints exposed. The area between joints may be backfilled as necessary to prevent pipe movement.

#### 3.8.2.1 Cleaning Carrier Pipe

Prior to testing, the interior of the carrier pipe shall be cleaned of foreign materials by thorough flushing with clean water. Water shall be circulated at a velocity between 2 and 3 m/s (7 and 10 feet per second) for a minimum of 4 hours. If required, temporary and/or supplementary pumps shall be provided to ensure that required velocity is achieved. System strainers shall be cleaned after the flushing operation is complete. Temporary strainers shall be installed as required. After flushing, the water shall remain in the piping system for testing of the system. All air shall be removed from the system prior to starting the tests.

#### 3.8.2.2 Hydrostatic Pressure Cycling and Tests

Hydrostatic pressure cycling shall have 4 cycles. Each cycle shall consist of a 10 minute period at 1000 kPa followed by a 5 minute period at a pressure less than 350 kPa. The next cycle shall begin immediately following the completion of the previous cycle. Pressure rise and drop shall not exceed 690 kPa per minute. The pressure gauge shall be located and the pressure measured at the opposite end of the system from where the pressure is applied. After completion of the hydrostatic pressure cycling, the first hydrostatic pressure test shall be performed. During the first hydrostatic pressure test, the system shall be proven tight at a pressure of 1-1/2 times the working pressure up to 1000 kPa. This pressure shall be held for a minimum of 1 hour. The method of pressurizing the system shall be disconnected from the system before starting the 1 hour pressure holding period. If the pressure cannot be held for the specified length of time, the cause of pressure loss shall be determined, corrected and the hydrostatic pressure cycling and first hydrostatic pressure test shall be repeated until the system can hold the required pressure for at least 1 hour. After successful completion of the first hydrostatic pressure test, the water shall be drained out of the piping system and the piping system filled with treated water as defined in paragraph TREATED WATER for the remaining tests and for permanent operation of the system. The hydrostatic pressure cycling and tests shall be repeated after the system has been filled with treated water, using the same test conditions and criteria.

#### 3.8.2.3 Operational Test

Operational test shall be performed on the complete system or testable portions thereof. The test shall be conducted with full design flows and operating temperatures in all runs of piping as if in service, to demonstrate satisfactory function and operating effectiveness. The operational test will have two cycles. Each cycle shall consist of a 6-hour period with treated water in the system at the maximum operating temperature of 14.4 degrees C and maximum flow rate, and a period of at least 6-hours with no flow. The Contractor shall supply temporary pumps, piping connections, chillers and the gauges required to circulate the water at the desired temperatures and flow rates. Water shall be circulated through supply lines and returned through the return piping to demonstrate that the pressure drop is compatible with the flow rate and size of pipe and to show that obstructions do not exist in the piping system. Any unusual indicated pressure drop will be investigated and any obstructions removed. Any leaks found shall be repaired. After any obstructions have been removed and any leaks repaired, the operational test shall be repeated until successfully passed.

#### 3.8.2.4 Final Hydrostatic Test

After successful completion of the operational test, the system shall be pressurized to 1-1/2 times the working pressure up to 1000 kPa. This pressure shall be held for a minimum of 4 hours. Means of pressurizing shall be disconnected prior to the start of the 4-hour pressure holding period. If the pressure cannot be held for the specified length of time, the cause of the pressure loss shall be determined, corrected, and all of the hydrostatic pressure cycling and tests repeated.

-- End of Section --

## SECTION 02570

VALVE MANHOLES AND PIPING AND EQUIPMENT IN VALVE MANHOLES  
**09/98**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designations only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI H35.1 (1997) Alloy and Temper Designation Systems  
for Aluminum

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53/A 53M	(1999b) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 106	(1999e1) Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A 123/A 123M	(1997e1) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 193/A 193M	(1999) Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
ASTM A 194/A 194M	(1999) Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service
ASTM A 234/A 234M	(1999) Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM A 733	(1999) Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples
ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(1995) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM C 449/C 449M	(1995) Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

ASTM C 533	(1995) Calcium Silicate Block and Pipe Thermal Insulation
ASTM C 547	(1995) Mineral Fiber Pipe Insulation
ASTM C 552	(1991) Cellular Glass Thermal Insulation
ASTM C 647	(1995) Properties and Tests of Mastics and Coating Finishes for Thermal Insulation
ASTM D 2822	(1991; R 1997el) Asphalt Roof Cement
ASTM D 3278	(1996el) Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus
ASTM E 84	(1999) Surface Burning Characteristics of Building Materials
ASTM E 96	(1995) Water Vapor Transmission of Materials
ASTM F 1139	(1988; R 1998) Standard Specification for Steam Traps and Drains

## ASME INTERNATIONAL (ASME)

ASME B1.20.1	(1983; R 1992) Pipe Threads, General Purpose (Inch)
ASME B16.5	(1996; B16.5a) Pipe Flanges and Flanged Fittings NPS 1/2 thru NPS 24
ASME B16.9	(1993) Factory-Made Wrought Steel Buttwelding Fittings
ASME B16.11	(1996) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(1992) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B16.34	(1997) Valves - Flanged, Threaded, and Welding End
ASME B31.1	(1998) Power Piping
ASME B40.1	(1991) Gauges - Pressure Indicating Dial Type - Elastic Element
ASME BPV IX	(1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

## MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-25	(1998) Standard Marking System for Valves, Fittings, Flanges, and Unions
MSS SP-45	(1998) Bypass and Drain Connections
MSS SP-58	(1993) Pipe Hangers and Supports - Materials, Design and Manufacture
MSS SP-69	(1996) Pipe Hangers and Supports - Selection and Application
MSS SP-72	(1999) Ball Valves with Flanged or Butt-Welding Ends for General Service
MSS SP-80	(1997) Bronze Gate, Globe, Angle and Check Valves
MSS SP-83	(1995) Class 3000 Steel Pipe Unions Socket-Welding and Threaded
MSS SP-110	(1996) Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

#### NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1999) National Electrical Code
NFPA 90A	(1999) Installation of Air Conditioning and Ventilating Systems

#### THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 16	(1991) Coal Tar Epoxy-Polyamide Black (or Dark Red) Paint
SSPC SP 10/NACE 2	(1994) Near-White Blast Cleaning

#### UNDERWRITERS LABORATORIES (UL)

UL 723	(1996; Rev thru Dec 1998) Test for Surface Burning Characteristics of Building Materials
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### 1.2 DESCRIPTION

This specification covers valve manholes and the valves and equipment shown in the manholes on the drawings.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete



system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-02 Shop Drawings

Valve Manholes, Pipe, and Equipment; GA-BK, GA-CH, GA-DN, GA-HQ.

Detail drawings for valve manholes and the piping and equipment in the valve manholes, such as steam traps, valves, sump pumps, pressure gauges, thermometers and insulation, including a complete list of equipment and materials, including manufacturer's descriptive and technical literature, performance charts and curves, catalog cuts, and installation instructions. Drawings shall also contain complete wiring and schematic diagrams. Drawings shall show pipe anchors and guides, and layout and anchorage of equipment and appurtenances in valve manholes, and equipment relationship to other parts of the work including clearances for maintenance and operation.

#### SD-04 Samples

Insulated Sections; GA-AO.

Display sample sections for insulation of pipe, elbow, tee, valve, support point, and terminating points. After approval of materials and prior to insulation of piping, a display shall be prepared of insulated sections showing compliance with specifications including showing fastening, sealing, jacketing, straps, waterproofing, supports, hangers, anchors, and saddles. Approved display sample sections shall remain on display at the jobsite during the construction period until no longer needed by Contracting Officer, then removed.

#### SD-10 Operation and Maintenance Data

Valve Manholes, Pipe, and Equipment

Six copies of operation and six copies of maintenance manuals shall be provided for the equipment furnished. Operation manuals shall detail the step-by-step procedures required for equipment startup, operation, and shutdown. Operation manuals shall include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features. Maintenance manuals shall list routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals shall include piping and equipment layout and simplified wiring and control diagrams indicating location of electrical components with terminals designated for wiring, as installed.

### 1.4 DELIVERY AND STORAGE

All materials and equipment delivered and placed in storage shall be stored with protection from the weather, excessive humidity and excessive temperature variation; and dirt, dust, or other contaminants.

#### 1.5 FIELD MEASUREMENTS

The Contractor shall become familiar with all details of the work, verify all dimensions in the field, and shall advise the Contracting Officer of any discrepancy before performing the work.

### PART 2 PRODUCTS

#### 2.1 STANDARD PRODUCTS

Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site.

#### 2.2 NAMEPLATES

Each major item of equipment such as sump pump, motor, steam trap, and pressure reducing valve shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the item of equipment.

#### 2.3 ASBESTOS PROHIBITION

Asbestos and asbestos-containing products shall not be used.

#### 2.4 ELECTRICAL WORK

Motors, manual or automatic motor control equipment, and protective or signal devices required for the operation specified shall be provided under this section in accordance with NFPA 70 and Section 16375, ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

#### 2.5 PIPING AND FITTINGS

##### 2.5.1 General Requirements

Piping, fittings and piping accessories inside the valve manholes shall conform to the requirements of ASME B31.1 and shall be suitable for the working pressure and temperature requirements of the system. To the greatest extent possible, the piping and fittings inside the valve manholes shall match the piping and fittings located on the outside of the valve manhole. All piping in valve manholes shall be steel with joints welded except that joints 20 mm and smaller may be threaded. No supports, anchors, or stays shall be attached to any piping system in places where either the installation of or the movement of the pipe and its contents will cause damage to the construction.

## 2.5.2 Steel Pipe

Pipe shall be black steel, seamless or electric-resistance welded, conforming to the requirements of ASTM A 53/A 53M, Grade B or ASTM A 106, Grade B. Pipe up to and including 250 mm in diameter shall be schedule 40. Pipe 300 mm in diameter and greater shall be 10 mm nominal wall thickness. Piping 20 mm in diameter and smaller shall be schedule 80.

### 2.5.2.1 Nipples

Nipples shall conform to ASTM A 733 as required to match adjacent piping.

### 2.5.2.2 Pipe Threads

Pipe threads shall conform to ASME B1.20.1. Pipe threads may be used only on pipe 20 mm or smaller. All pipe which is to be threaded shall be schedule 80.

## 2.5.3 Fittings

All fittings, valves, flanges and unions shall have the manufacturer's trademark affixed in accordance with MSS SP-25 so as to permanently identify the manufacturer.

### 2.5.3.1 Welded Fittings

Welded fittings shall conform to ASTM A 234/A 234M, buttwelded or socket welded, as required to match connecting piping. Buttwelded fittings shall conform to ASME B16.9, and socket welded fittings shall conform to ASME B16.11.

### 2.5.3.2 Unions

Unions shall conform to MSS SP-83 as required to match adjacent piping.

### 2.5.3.3 Ball Valves

Ball valves shall conform to MSS SP-72 for flanged or buttwelded valves or MSS SP-110 for threaded ball valves.

## 2.5.4 Insulating Flanges and Dielectric Unions

### 2.5.4.1 Insulating Flanges

For systems in which cathodic protection is provided, insulating flanges or flange gasket kits shall be installed in the valve manhole at the pipe connection to or from the chilled water distribution system and at dissimilar metals and when the carrier pipe and appurtenances are supported in such a way as to electrically ground or alter the cathodic protection system voltages or currents. The kit shall consist of flanges, a flange gasket, nuts and bolts, bolt sleeves, and one insulating washer and one steel washer for both ends of each bolt. The manufacturer shall certify that the gasket kits are capable of electrically isolating the pipe at the 1034 kPa pressure and 5.6 temperature of the heating medium at the point of

application. Evidence of satisfactory installations operating not less than 2 years shall be submitted in accordance with paragraph SUBMITTALS before materials are delivered. The Contractor shall ensure that these kits are provided and properly installed according to manufacturer's published instructions. Bolts shall be torqued to the correct tightness and in the correct bolt pattern as recommended by the manufacturer's published instructions. Steel flanges shall conform to ASME B16.5 Class 150 and or 300 and shall match valves or flanged fittings on which used. Steel flanges shall be flat faced. Gaskets shall be non-asbestos compressed material in accordance with ASME B16.21, 2 mm thickness, full face or self centering flat ring type. Bolts shall conform to the requirements of ASTM A 193/A 193M, Grade B7. The bolt head shall be marked to identify the manufacturer and the standard to which the bolt complies. Lengths of bolts shall be such that not less than two full threads extend beyond the nut with the bolt tightened to the required tension and the washer seated. Nuts shall conform to the requirements of ASTM A 194/A 194M, Grade 7.

#### 2.5.4.2 Dielectric Unions

Dielectric unions, pressure rated to match the pressure on the system used, shall be used for joining dissimilar metals on 20 mm and smaller threaded pipe.

### 2.6 VALVES

Unless otherwise specified, valves shall comply with the material, fabrication, and operating requirements of ASME B31.1. Valves shall be suitable for the temperature and pressure requirements of the system on which used. Valves for chilled water shall conform to ASME B31.1 Class 150, as suitable for the application. Valves 20 mm and smaller may be bronze where seal welding is not required. Valves 150 mm and larger shall have a 25 mm (1 inch) minimum gate or globe bypass valve sized in conformance with MSS SP-45.

#### 2.6.1 Steel Valves

Steel globe, gate, angle, and check valves shall conform to the requirements of ASME B16.34 and ASME B31.1 for the temperature and pressure requirements of the system. Gate valves 65 mm and smaller shall be rising stem. Gate valves 80 mm and larger shall be outside screw and yoke.

#### 2.6.2 Bronze Valves

##### 2.6.2.1 Globe, Gate, and Angle Valves

Bronze globe, gate, and angle valves shall conform to requirements of MSS SP-80, union bonnet type.

##### 2.6.2.2 Check Valves

Bronze check valves shall conform to the requirements of MSS SP-80.

#### 2.6.3 Packing

Packing used with valves shall not contain asbestos. Valve stem packing shall be die-formed, ring type specifically designated as suitable for the temperature and pressure of the service and compatible with the fluid in the system. Packing shall be polytetrafluoroethylene with minimum 50 percent graphite filament. Valves 40 mm and smaller shall have four or five packing rings and valves 50 mm and larger shall have at least six packing rings. Spiral or continuous packing will not be acceptable. A metal insert shall be provided having proper clearance around the valve stem at the bottom of the stuffing box and acting as a base for the packing material. Packing glands shall be furnished with a liner of noncorrosive material and shall be of one piece construction with provisions for not less than two bolts for packing adjustment.

## 2.7 INSULATION AND JACKETING

### 2.7.1 General Provisions

All piping, fittings, valves, etc., in the valve manholes shall be insulated. Insulation shall be premolded, precut or job fabricated to fit and shall be removable and reusable. Thickness of insulation shall be in accordance with Tables 1 and 2. Insulation jackets shall be provided for all pipe and fitting insulation.

### 2.7.2 Insulation

Insulation for all piping, fittings, and valves shall be molded calcium silicate conforming to ASTM C 533, Type I, or molded mineral fiber insulation conforming to ASTM C 547, Class 2, or cellular glass insulation conforming to ASTM C 552. All insulation shall be asbestos free.

### 2.7.3 Aluminum Jackets

Aluminum jackets shall be smooth sheet, 0.4064 mm nominal thickness and conform to the requirements of ASTM B 209M, Type 3003, 3105, or 5005. Aluminum jackets shall be supplied with a factory installed moisture barrier. This moisture barrier shall consist of at least 18.1 kg kraft paper coated on one side with a 0.025 mm thick polyethylene film. The moisture barrier shall be adhered to the aluminum jacket over the entire area of the aluminum jacket surface.

### 2.7.4 Bands

Bands for aluminum jacket shall be 10 mm wide and 32 gauge thickness made of aluminum or annealed stainless steel. Bands for insulation shall be 15 mm wide and 32 gauge thickness made of annealed stainless steel.

### 2.7.5 Insulation for Flanges, Unions, Valves, and Fittings

Flanges, unions, valves, and fittings shall be insulated with premolded prefabricated, or field fabricated segments of insulation of the same material and thickness as the manhole pipe insulation. Insulation shall be removable and reusable and shall have essentially the same thermal characteristics and thickness as the adjoining piping.

#### 2.7.6 Vapor Barrier Coating

The vapor barrier coating shall be fire and water resistant and appropriately selected for either outdoor or indoor service. Color shall be white. The water vapor permeance of the compound shall not exceed 0.05 perm and shall be determined according to Procedure B of ASTM E 96. The coating shall be a nonflammable, fire resistant type conforming to ASTM E 84, NFPA 90A and UL 723. The flash point of the compound shall not be less than 26.7 degrees C and shall be determined in accordance with ASTM D 3278. All other application and service properties shall be in accordance with ASTM C 647.

#### 2.7.7 Finishing Cement

Mineral fiber hydraulic-setting thermal insulating cement in accordance with ASTM C 449/C 449M.

#### 2.7.8 Glass Tape

Glass tape shall meet the requirements of UL 723 and ASTM E 84.

#### 2.7.9 Plain Weave, Untreated

The ends shall be properly interlocked with the picks to ensure that there shall be no raveling of the tape edges. The tape shall have an average weight of 196.7 plus or minus 10 percent grams per square meter. An average thickness of 0.1778 plus or minus 0.0254 mm. Warp ends/wales of 17 plus or minus 1 per centimeter or filling picks/courses of 13 plus or minus 1 per centimeter, a minimum breaking strength of 2679 grams per mm of width, and after heating to 482 degrees C for 2 hours. A minimum breaking strength of 714 grams per mm of width.

#### 2.7.10 Knitted, Untreated

The wales shall be properly interlocked with the courses to ensure that there shall be no raveling of the tape edges. The tape shall have an average weight of 153 plus or minus 10 percent grams per square meter. An average thickness of 0.1778 plus or minus 0.0254 mm, warp ends/wales of 6 plus or minus per 1 centimeter. A minimum breaking strength of 714 grams per mm of width and, after heating to 482 degrees C for 2 hours. A minimum breaking strength of 375 grams per mm of width.

#### 2.7.11 Distortion Requirements

There shall be no distortion of the tape when a sample 610 mm in length is spread across a flat horizontal surface and observed for evidence of distortion (such as tendency to curl rather than lie flat). The width tolerance is plus or minus 3.175 mm.

#### 2.7.12 Open-Weave Type

Tape shall be open-weave type and shall have an average weight of \_\_\_\_\_ kg per square meter and shall be used for embedding between coats of adhesive or coating materials.

## 2.8 SUMP PUMPS

Sump pumps with the capacities indicated shall be installed in the valve manholes as shown. The sump pumps furnished shall be a manufacturer's standard commercial product. Sump pumps shall be electrically driven and submersible, capable of operating while completely submerged. The pumps and motors shall be capable of continuously pumping liquids at a temperature of 93 degrees C. The pumps and motors shall be capable of running without damage when not submerged. Sump pumps shall have permanently lubricated bearings, monel shafts, bronze impellers, screened inlets and housings of bronze. Each sump pump shall be capable of passing a 10 mm sphere. The motors shall have the wattage indicated and shall have overload protection. The discharge piping shall be schedule 80 or shall be protected from corrosion. The pumps shall be automatically controlled by a submersible switch assembly with pump wiring and switch suitable for submersion in 93 degrees liquids. Motors shall be 120 240 \_\_\_\_\_ volts, 60 Hz, single phase. Two sump pumps in a duplex arrangement shall be provided as indicated. An automatic alternating lead-lag controller shall be furnished. All controllers, water level switches, and electrical connections shall be suitable for service at 100 percent humidity, at 93 degrees C temperature, and occasional water submersion. The sump pumps automatic control switches shall have demonstrated 200,000 cycles at 93 degrees C and 100 percent relative humidity and shall withstand total submersion in water at 93 degrees C. Another switch shall be provided to indicate high water level, and shall be connected to an emergency warning light mounted on or adjacent to the valve manhole as indicated. This high water level alarm shall be set at a level which is below the bottom of any pipe in the valve manhole. Auxiliary contacts in a separate junction box shall be provided to permit connection to a future Energy Monitoring and Control System (EMCS) for monitoring the operation of each pump motor and the high water level alarm system.

## 2.9 CONCRETE VALVE MANHOLES AND ACCESSORIES

### 2.9.1 Valve Manhole Construction

Valve manhole dimensions shall be as indicated. The valve manholes shall be constructed of reinforced concrete as indicated and in accordance with Section 03300 CAST IN PLACE STRUCTURAL CONCRETE. Valve manholes shall be drained as shown. Concrete sections shall not be less than 150 mm thick. solid plate cover (8 mm thick checker pattern) conforming to ANSI H35.1.

### 2.9.2 Ladders

Valve manhole ladders shall be steel, shall have nonslip surfaces, and shall consist of uprights with steps or rungs. Ladders shall not be less than 406.4 mm in width, with 19.1 mm diameter rungs, spaced 304.8 mm apart. The two stringers shall be a minimum 9.5 mm thick and 63.5 mm wide. Ladders shall be adequately anchored to the wall by means of steel inserts spaced not more than 2 m apart vertically, and installed to provide at least 150 mm of space between the wall and rungs. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A 123/A 123M.

### 2.9.3 Pipe Sleeves

Pipe sleeves of sufficient length to pass through valve manhole or building walls shall be provided. Pipe sleeves shall be zinc-coated steel pipe, conforming to the requirement of ASTM A 53/A 53M, Schedule 40 or standard weight. The pipe sleeves shall be secured in the proper position and location during construction of the valve manhole or building wall. For manhole top penetrations, the diameter of the pipe sleeve will be large enough to allow at least 6 mm of clearance between the pipe insulation and the sleeve, and, the sleeve will be sized to accommodate the specific mechanical seal size used for the conduit penetration. The space between the sleeve and the pipe casing, and the caulking and sealing materials shall be selected so there shall be NO electrical continuity between the pipe sleeve and the pipe casing when finished.

#### 2.9.3.1 Pipe Sleeves for Conduit Penetrations

A modular mechanical type sealing assembly will be used between the valve manhole pipe sleeve and the conduit casing. The mechanical seal shall consist of interlocking elastomeric links shaped to continuously fill the annular space between the casing and sleeve. The link material shall be a synthetic elastomeric capable of withstanding long term exposure at 205 degrees C without deterioration. The links shall be attached to each other with corrosion resistant steel bolts, nuts and pressure plates. The link, bolts, nuts and pressure plates shall be the product of single manufacturer and shall be furnished as the product of single manufacturer and shall be furnished as a package or kit. The links shall be loosely assembled with bolts to form a continuous rubber belt around the casing with a pressure plate under each bolt head and each nut. After the seal assembly is properly positioned in the sleeve, tightening of the bolt shall cause the rubber sealing elements to expand and provide a watertight seal between the casing and the sleeve. The pipe sleeve diameter shall be sized so that no more than one half of the seal assembly's expansion capability is used to achieve a water seal.

#### 2.9.4 Pipe Supports

Pipe Supports shall be in accordance with MSS SP-58 and MSS SP-69, type as shown. All pipe supports, including structural cross support members, shall be galvanized in accordance with Section 05500 MISCELLANEOUS METAL. Chains, straps, or single point supports shall not be used.

#### 2.10 MISCELLANEOUS METAL

Miscellaneous metal not otherwise specified, shall conform to Section 05500 MISCELLANEOUS METAL. Miscellaneous metal bolted together, shop welded, or assembled in the field, and pipe supports, including structural cross support members and anchors, shall be hot-dip galvanized in accordance with Section 05500 MISCELLANEOUS METAL.

### PART 3 EXECUTION

#### 3.1 SITE WORK

##### 3.1.1 Excavation, Trenching, and Backfilling



Excavation, trenching, and backfilling of the valve manholes shall be as shown and in accordance with Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

### 3.1.2 Electric Work

Any wiring required for the operation of the equipment specified, but not shown on the electrical drawings, shall be provided under this section in accordance with Section 16370 ELECTRICAL DISTRIBUTION SYSTEM, AERIAL, and Section 16375 ELECTRICAL DISTRIBUTION SYSTEM, UNDERGROUND.

## 3.2 PIPING

### 3.2.1 General

All piping in valve manholes shall be steel and insulated. Insulation shall be protected with an aluminum jacket. Pipe shall be accurately cut to measurements established at the site and shall be worked into place without springing or forcing. Pipe and insulation shall clear all openings and equipment. Excessive cutting or other weakening of structural members to facilitate piping installation will not be permitted. Burrs shall be removed from ends of pipe by reaming. Installation shall permit free expansion and contraction without damage to joints or hangers. Piping shall be installed in accordance with ASME B31.1. Joints for piping in valve manholes shall be welded. Supports, anchors, or stays shall not be attached where either expansion or the weight of the pipe will cause damage to permanent construction. The method of attaching supports shall not interfere with the operation of the cathodic protection system.

### 3.2.2 Welded Joints

Joints between sections of pipe, between sections of pipe and valves, and between sections of pipe and fittings shall be welded except where joints are allowed to be screwed for pipe sizes 20 mm and smaller. The welding shall conform to the requirements specified in paragraph WELDING.

### 3.2.3 Flanged and Threaded Joints

#### 3.2.3.1 Flanged Joints

Flanged joints shall be faced true, provided with gaskets, and made perfectly square and tight. Flanged joints shall be used only for electrical isolation and in other special cases where connected equipment is available with only flanged joints, or when specifically shown on the drawings. Electrically isolated flange joints shall be provided at all connections to or from the heat distribution system and between dissimilar metals.

### 3.2.4 Reducing Fittings

Eccentric reducers in horizontal runs shall be installed with the straight side down. Changes in horizontal piping sizes shall be made through eccentric reducing fittings.

### 3.2.5 Branch Connections

Branches from mains shall branch off top of mains as indicated or as approved. Connections shall ensure unrestricted circulation, elimination of air pockets, and shall permit the complete drainage of the system. Branch connections may be made with either welding tees or forged branch outlet fittings. Branch outlet fittings where used shall be forged and shall be no larger than two nominal pipe sizes smaller than the main run. Branch outlet fittings shall be reinforced to withstand external strains and designed to withstand full pipe bursting strength.

### 3.2.6 Pipe Supports in Valve Manholes

Horizontal and vertical runs of pipe in valve manholes shall be securely supported.

## 3.3 WELDING

Piping shall be welded in accordance with qualified procedures, using performance qualified welders and welding operators. Procedures and welders shall be qualified in accordance with ASME BPV IX. Welding procedures qualified by others, and welders and welding operators qualified by another employer may be accepted as permitted by ASME B31.1. The Contracting Officer shall be notified 24 hours in advance of tests and the tests shall be performed at the work site. The welder or welding operator shall apply his assigned symbol near each weld he makes as a permanent record.

## 3.4 INSULATION

The insulation shall be installed so that it will not be damaged by pipe expansion or contraction. Insulation shall not become wet before, during, or after installation. Insulation installed over welds shall be grooved to assure a snug fit. Insulation shall be held in place with stainless steel straps. A minimum of 2 bands shall be installed on each individual length of insulation and maximum spacing shall not exceed 450 mm centers.

### 3.4.1 Installation

Material shall be installed in accordance with published installation instructions of the manufacturer. Insulation materials shall not be applied until piping tests are completed. Prior to application, surfaces shall be thoroughly cleaned of moisture, grease, dirt, rust, and scale, and painted where required.

### 3.4.2 Insulation on Pipes Passing Through Sleeves

Insulation shall be continuous, as required by paragraph Pipe Sleeves Through Valve Manhole Cover. Aluminum jackets shall be provided over the insulation. When penetrating valve manhole walls, aluminum jacket shall extend not less than 50 mm beyond the sleeve on each side of the wall and shall be secured with an aluminum band on each side of the wall. Where flashing is provided, the jacket shall be secured with not less than one band located not more than 25 mm from the end of the jacket. When

penetrating valve manhole tops, pipe shall be insulated as required for valve manhole service as indicated.

#### 3.4.3 Covering of Insulation in Valve Manholes

The insulation for pipe, flanges, valves, and fittings shall be covered with aluminum jackets.

#### 3.4.4 Insulation of Piping Accessories in Valve Manholes

Flanges, couplings, unions, valves, fittings, and other pipe accessories, unless otherwise shown or approved, shall be insulated with removable and reusable factory premolded, prefabricated, or field fabricated insulation. For accessories in valve manholes, aluminum sheet shall be applied over the insulation. Where accessories are designated not to be insulated, the adjoining insulation and jacket shall terminate neatly. The terminations for the chilled water systems shall provide a complete vapor seal.

#### 3.4.5 Insulation Sealing for Chilled Water Systems

The ends of insulation shall be sealed with vapor barrier. Penetrations shall be caulked. Caulking shall be applied to parting line between equipment and removable section insulation. Upon completion of installation of the insulation, including removable sections, two coats of vapor barrier coating shall be applied with a layer of glass cloth embedded between the coats. The total dry thickness of the finish shall be 1.6 mm. The coating shall be applied so that the removable sections are coated separate from the body of the equipment so these sections remain removable. Coating shall be applied to flanges, unions, valves, anchors, fittings and accessories, all terminations, and all insulation not protected by factory vapor barrier jackets or PVC fitting covers. Tape seams shall overlap 25 mm. The coating shall extend out onto the adjoining pipe insulation 50 mm. Insulation terminations shall be tapered to unions at a 45-degree angle.

### 3.5 VALVE MANHOLES AND ACCESSORIES

#### 3.5.1 Piping and Equipment in Valve Manholes

Piping and equipment in valve manholes shall be installed to provide easy access without stepping on piping or equipment, and to provide sufficient working room. Piping and equipment in valve manholes shall be installed and supported as shown on the drawings. All globe, angle and gate valves shall be installed with the stems horizontal or above.

#### 3.5.2 Sump Pumps Installation

Sump pumps shall be installed as indicated. Pumps shall be connected to a dedicated electrical service. All electrical connections shall be hard wired. Monitoring of each pump motor and the high water alarm shall be connected to the Energy Monitoring and Control System (EMCS). Coordinate electrical requirements of EMCS with Section 16415 ELECTRICAL WORK, INTERIOR. Electrical circuits to the sump pumps shall be dedicated circuits. All circuit breakers and switches in the electrical power distribution to the sump pumps shall be capable of being locked in the "ON"

position.

### 3.6 TESTS

Tests of piping in the valve manholes will be performed as part of the testing of the direct buried conduit system. These tests shall include the piping in the valve manhole and shall be in accordance with the system supplier's Approved Brochure or the contract specifications.

-- End of Section --

## SECTION 02620

## SUBDRAINAGE SYSTEM

08/97

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 252 (1996) Corrugated Polyethylene Drainage Tubing

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 27/A 27M (1996) Steel Castings, Carbon, for General Application

ASTM A 47 (1990; R 1995) Ferritic Malleable Iron Castings

ASTM A 48 (1994a) Gray Iron Castings

ASTM A 123/A 123M (1997a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 227/A 227M (1993) Steel Wire, Cold-Drawn for Mechanical Springs

ASTM A 229/A 229M (1993) Steel Wire, Oil-Tempered for Mechanical Springs

ASTM C 55 (1997) Concrete Brick

ASTM C 62 (1997) Building Brick (Solid Masonry Units Made from Clay or Shale)

ASTM C 150 (1997) Portland Cement

ASTM C 231 (1997) Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C 478 (1997) Precast Reinforced Concrete Manhole Sections

ASTM D 1751 (1983; R 1991) Preformed Expansion Joint

	Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 2751	(1996a) Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings
ASTM D 3034	(1998) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 5034	(1995) Breaking Strength and Elongation of Textile Fabrics (Grab Test)
ASTM F 405	(1996) Corrugated Polyethylene (PE) Tubing and Fittings
ASTM F 667	(1997) Large Diameter Corrugated Polyethylene Tubing and Fittings
ASTM F 758	(1995) Smooth-Wall Poly(Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage
ASTM F 949	(1996a) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

### SD-07 Certificates

#### Filter Fabric Pipe for Subdrains

Certifications from the manufacturers attesting that materials meet specification requirements. Certificates are required for drain pipe, drain tile, fittings, and filter fabric.

### 1.3 DELIVER, STORAGE, AND HANDLING

#### 1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with minimum handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. During shipment and storage, filter fabric shall be wrapped in burlap or similar heavy duty protective covering. The storage area shall protect the fabric from mud, soil, dust, and debris. Filter fabric materials that are not to be installed immediately shall not be stored in direct sunlight. Plastic pipe shall be installed within 6 months from the date of manufacture unless otherwise approved.

#### 1.3.2 Handling

Materials shall be handled in such a manner as to insure delivery to the trench in sound undamaged condition. Pipe shall be carried and not dragged to the trench.

## PART 2 PRODUCTS

### 2.1 PIPE FOR SUBDRAINS

Pipe for subdrains shall be of the types and sizes indicated.

#### 2.1.1 Plastic Pipe

Plastic pipe shall contain ultraviolet inhibitor to provide protection from exposure to direct sunlight.

##### 2.1.1.1 Acrylonitrile-Butadiene-Styrene (ABS) Piping

Acrylonitrile-butadiene-styrene (ABS) piping and fittings shall conform to ASTM D 2751, with maximum SDR of 35.

##### 2.1.1.2 Polyvinyl Chloride (PVC) Pipe and Fittings

Polyvinyl chloride (PVC) pipe and fittings shall conform to ASTM D 3034, ASTM F 949, ASTM F 758, Type PS 46.

##### 2.1.1.3 Corrugated Polyethylene (PE) Pipe and Fittings

Use AASHTO M 252 for pipes 80 to 250 mm, diameter. Fittings shall be manufacturer's standard type and shall conform to the indicated specification.

##### 2.1.1.4 Pipe Perforations

Water inlet area shall be a minimum of 1,058.4 mm squared per linear meter.

Manufacturer's standard perforated pipe which essentially meets these requirements may be substituted with prior approval of the Contracting Officer.

- a. Circular Perforations in Plastic Pipe: Circular holes shall be cleanly cut not more than 9.5 mm or less than 4.8 mm in diameter and arranged in rows parallel to the longitudinal axis of the pipe. Perforations shall be approximately 76.2 mm center-to-center along rows. The rows shall be approximately 38.1 mm apart and arranged in a staggered pattern so that all perforations lie at the midpoint between perforations in adjacent rows. The rows shall be spaced over not more than 155 degrees of circumference. The spigot or tongue end of the pipe shall not be perforated for a length equal to the depth of the socket, and perforations shall continue at uniform spacing over the entire length of the pipe.
- b. Slotted Perforations in Plastic Pipe: Circumferential slots shall be cleanly cut so as not to restrict the inflow of water and uniformly spaced along the length and circumference of the tubing. Width of slots shall not exceed 3.2 mm nor be less than 0.8 mm. The length of individual slots shall not exceed percent of the tubing inside nominal circumference on 100 to 200 mm diameter tubing. Rows of slots shall be symmetrically spaced so that they are fully contained in 2 quadrants of the pipe. Slots shall be centered in the valleys of the corrugations of profile wall pipe.

## 2.2 FILTER FABRIC

Filter fabric shall be a pervious sheet of polyester, nylon, or polypropylene filaments woven or otherwise formed into a uniform pattern with distinct and measurable openings. The filter fabric shall provide an equivalent opening size (AOS) no finer than the US Standard Sieve No. 100 0.15 mm and no coarser than the US Standard Sieve No. 70 0.21 mm. AOS is defined as the number of the US Standard sieve having openings closest in size to the filter fabric openings. Percent open area is defined as the summation of open areas divided by the total area of the filter fabric and expressed as a percent. The filaments shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of propylene, ethylene, or vinylidene-chloride, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultraviolet and heat exposure. The fabric shall have a minimum physical strength of 710 N per meter in any direction when tested in accordance with ASTM D 5034 using the grab test method with 645.2 square mm jaws and a constant rate of travel of 304.8 mm per minute. The edges of the fabric shall be selvaged or otherwise finished to prevent the outer material from pulling away from the fabric.

## 2.3 SUBDRAIN FILTER MATERIAL

Shall be in accordance with Section 02714, "DRAINAGE LAYER".

## PART 3 EXECUTION

### 3.1 EXCAVATION AND BEDDING FOR SUBDRAIN SYSTEMS

Trenching and excavation, including the removal of rock and unstable material, shall be in accordance with Section 02316 EXCAVATION, TRENCHING,



AND BACKFILLING FOR UTILITIES SYSTEMS. Bedding material shall be placed in the trench as indicated or as required as replacement materials used in those areas where unstable materials were removed. Compaction of the bedding material shall be as specified for cohesionless material in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

### 3.2 INSTALLATION OF FILTER FABRIC AND PIPE FOR SUBDRAINS

#### 3.2.1 Installation of Filter Fabric

##### 3.2.1.1 Trench Lining and Overlaps

Trenches to be lined with filter fabric shall be graded to obtain smooth side and bottom surfaces so that the fabric will not bridge cavities in the soil or be damaged by projecting rock. The fabric shall be laid flat but not stretched on the soil, and it shall be secured with anchor pins. Overlaps shall be at least 305 mm, and anchor pins shall be used along the overlaps.

#### 3.2.2 Installation of Pipe for Subdrains

##### 3.2.2.1 Pipelaying

Each pipe shall be carefully inspected before it is laid. Any defective or damaged pipe shall be rejected. No pipe shall be laid when the trench conditions or weather is unsuitable for such work. Water shall be removed from trenches by sump pumping or other approved methods. The pipe shall be laid to the grades and alignment as indicated. The pipe shall be bedded to the established gradeline. Perforations shall be centered on the bottom of the pipe. Pipes of either the bell-and-spigot type or the tongue-and-groove type shall be laid with the bell or groove ends upstream. All pipes in place shall be approved before backfilling.

##### 3.2.2.2 Jointings

- a. Acrylonitrile-Butadiene-Styrene (ABS): Solvent cement or elastomeric joints for ABS pipe shall be in accordance with ASTM D 2751. Dimensions and tolerances shall be in accordance with TABLE II of ASTM D 2751.
- b. Polyvinyl Chloride (PVC) Pipe: Joints shall be in accordance with the requirements of ASTM D 3034, ASTM D 3212, or ASTM F 949.
- c. Perforated Corrugated Polyethylene Pipe: Perforated corrugated polyethylene drainage pipe shall be installed in accordance with the manufacturer's specifications and as specified herein. A pipe with physical imperfections shall not be installed. No more than 5 percent stretch in a section will be permitted.

### 3.3 INSTALLATION OF FILTER MATERIAL AND BACKFILLING FOR SUBDRAINS

After pipe for subdrains has been laid, inspected, and approved, filter material shall be placed around and over the pipe to the depth indicated. The filter material shall be placed in layers not to exceed 200 mm thick, and

each layer shall be compacted in accordance with Section 02714, "DRAINAGE LAYER". The placement and compaction of overlying backfill material shall be in accordance with the applicable provisions specified in Section 02316 EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS.

-- End of Section --

## SECTION 02630

STORM-DRAINAGE SYSTEM  
03/00

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ACI INTERNATIONAL (ACI)

ACI 346/346R	(1990) Standard Specification for Cast-in-Place Nonreinforced Concrete Pipe and Recommendations
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AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO HB-16	(1996) Standard Specifications for Highway Bridges
AASHTO M 167	(1994) Corrugated Steel Structural Plate, Zinc Coated, for Field Bolted Pipe
AASHTO M 190	(1995) Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches
AASHTO M 198	(1998) Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets
AASHTO M 219	(1992; R 1995) Aluminum Alloy Structural Plate for Field Bolted Conduits
AASHTO M 243	(1996) Field Applied Coating of Corrugated Metal Structural Plate for Pipe, Pipe-Arches, and Arches
AASHTO M 294	(1998) Corrugated Polyethylene Pipe, 300- to 1200- mm Diameter
AASHTO MP7	(1997) Corrugated Polyethylene Pipe, 1350 and 1500 mm Diameter

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE-OF-WAY ASSOCIATION  
(AREMA)

AREMA Manual	(1999) Manual for Railway Engineering (4 Vol.)
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## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 48	(1994a) Gray Iron Castings
ASTM A 48M	(1994 el) Gray Iron Castings (Metric)
ASTM A 123/A 123M	(1997ael) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 536	(1999el) Ductile Iron Castings
ASTM A 716	(1995) Ductile Iron Culvert Pipe
ASTM A 742/A 742M	(1998) Steel Sheet, Metallic Coated and Polymer Precoated for Corrugated Steel Pipe
ASTM A 760/A 760M	(1997) Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
ASTM A 762/A 762M	(1998) Corrugated Steel Pipe, Polymer Precoated for Sewers and Drains
ASTM A 798/A 798M	(1997a) Installing Factory-Made Corrugated Steel Pipe for Sewers and Other Applications
ASTM A 807	(1997) Installing Corrugated Steel Structural Plate Pipe for Sewers and Other Applications
ASTM A 849	(1997) Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe
ASTM A 929/A 929M	(1997) Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe
ASTM B 26/B 26M	(1998) Aluminum-Alloy Sand Castings
ASTM B 745/B 745M	(1997) Corrugated Aluminum Pipe for Sewers and Drains
ASTM C 12	(1998el) Installing Vitrified Clay Pipe Lines
ASTM C 14	(1999) Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C 14M	(1999) Concrete Sewer, Storm Drain, and Culvert Pipe (Metric)
ASTM C 32	(1999el) Sewer and Manhole Brick (Made from Clay or Shale)
ASTM C 55	(1999) Concrete Brick

ASTM C 62	(1997a) Building Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C 76	(1999) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C 76M	(1999a) Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C 139	(1999) Concrete Masonry Units for Construction of Catch Basins and Manholes
ASTM C 231	(1997e1) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 270	(1997) Mortar for Unit Masonry
ASTM C 425	(1998b) Compression Joints for Vitrified Clay Pipe and Fittings
ASTM C 443	(1998) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
ASTM C 443M	(1998) Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets (Metric)
ASTM C 478	(1997) Precast Reinforced Concrete Manhole Sections
ASTM C 478M	(1997) Precast Reinforced Concrete Manhole Sections (Metric)
ASTM C 506	(1999) Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe
ASTM C 506M	(1999) Reinforced Concrete Arch Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C 507	(1999) Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe
ASTM C 507M	(1999) Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe (Metric)
ASTM C 655	(1995a) Reinforced Concrete D-Load Culvert, Storm Drain, and Sewer Pipe
ASTM C 700	(1999) Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
ASTM C 789	(1998) Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers
ASTM C 828	(1998) Low-Pressure Air Test of Vitrified Clay

## Pipe Lines

ASTM C 850	(1998) Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than 2 Ft. of Cover Subjected to Highway Loadings
ASTM C 877	(1994) External Sealing Bands for Noncircular Concrete Sewer, Storm Drain, and Culvert Pipe
ASTM C 877M	(1994) External Sealing Bands for Noncircular Concrete Sewer, Storm Drain, and Culvert Pipe (Metric)
ASTM C 923	(1998) Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Materials
ASTM C 924	(1998) Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
ASTM C 924M	(1998) Concrete Pipe Sewer Lines by Low-Pressure Air Test Method (Metric)
ASTM C 1103	(1994) Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
ASTM C 1103M	(1994) Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines (Metric)
ASTM D 1056	(1998) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1171	(1994) Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
ASTM D 1557	(1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 1751	(1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996e1) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D 2167	(1994) Density and Unit Weight of Soil in

Place by the Rubber Balloon Method

ASTM D 2321	(1989; R 1995) Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
ASTM D 2922	(1996e1) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996e1) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 3034	(1998) Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
ASTM D 3212	(1996a) Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D 3350	(1998a) Polyethylene Plastics Pipe and Fittings Materials
ASTM F 477	(1999) Elastomeric Seals (Gaskets) for Joining Plastic Pipe
ASTM F 679	(1995) Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings
ASTM F 714	(1997) Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter
ASTM F 794	(1999) Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
ASTM F 894	(1998a) Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
ASTM F 949	(1999) Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings
ASTM F 1417	(1992; R 1998) Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package

shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-07 Certificates

Resin Certification  
Hydrostatic Test on Watertight Joints  
Determination of Density  
Frame and Cover for Gratings

Certified copies of test reports demonstrating conformance to applicable pipe specifications, before pipe is installed.  
Certification on the ability of frame and cover or gratings to carry the imposed live load.

#### SD-08 Manufacturer's Instructions

##### Placing Pipe

Printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

### 1.3 DELIVERY, STORAGE, AND HANDLING

#### 1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. The Contractor shall have a copy of the manufacturer's instructions available at the construction site at all times and shall follow these instructions unless directed otherwise by the Contracting Officer. Solvents, solvent compounds, lubricants, elastomeric gaskets, and any similar materials required to install plastic pipe shall be stored in accordance with the manufacturer's recommendations and shall be discarded if the storage period exceeds the recommended shelf life. Solvents in use shall be discarded when the recommended pot life is exceeded.

#### 1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

## PART 2 PRODUCTS

### 2.1 PIPE FOR CULVERTS AND STORM DRAINS



Pipe for culverts and storm drains shall be of the sizes indicated and shall conform to the requirements specified.

#### 2.1.1 Concrete Pipe

ASTM C 76M , Class as indicated.

#### 2.1.2 PVC Pipe

The pipe manufacturer's resin certification, indicating the cell classification of PVC used to manufacture the pipe, shall be submitted prior to installation of the pipe.

##### 2.1.2.1 Type PSM PVC Pipe

ASTM D 3034, Type PSM, maximum SDR 35, produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

##### 2.1.2.2 Profile PVC Pipe

ASTM F 794, Series 46, produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

##### 2.1.2.3 Smooth Wall PVC Pipe

ASTM F 679 produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

##### 2.1.2.4 Corrugated PVC Pipe

ASTM F 949 produced from PVC certified by the compounder as meeting the requirements of ASTM D 1784, minimum cell class 12454-B.

#### 2.1.3 PE Pipe

The pipe manufacturer's resin certification indicating the cell classification of PE used to manufacture the pipe shall be submitted prior to installation of the pipe. The minimum cell classification for polyethylene plastic shall apply to each of the seven primary properties of the cell classification limits in accordance with ASTM D 3350.

##### 2.1.3.1 Corrugated PE Pipe

AASHTO M 294, Type S or D, for pipes 300 to 1200 mm produced from PE certified by the resin producer as meeting the requirements of ASTM D 3350, minimum cell class in accordance with AASHTO M 294. Pipe walls shall have the following properties:

Nominal Size (mm)	Minimum Wall Area (square mm/m)	Minimum Moment of Inertia of Wall Section (mm to the 4th/mm)
300	3200	390
375	4000	870
450	4900	1020
600	6600	1900
750	8300	2670
900	9500	3640
1050	9900	8900
1200	10900	8900

#### 2.1.3.2 Profile Wall PE Pipe

ASTM F 894, RSC 160, produced from PE certified by the resin producer as meeting the requirements of ASTM D 3350, minimum cell class 334433C. Pipe walls shall have the following properties:

Nominal Size (mm)	Minimum Wall Area (square mm/m)	Minimum Moment Of Inertia of Wall Section (mm to the 4th/mm)	
		Cell Class 334433C	Cell Class 335434C
450	6300	850	620
525	8800	1150	840
600	9900	1330	970
675	12500	2050	1490
750	12500	2050	1490
825	14800	2640	2160
900	17100	3310	2700
1050	16500	4540	3720

## 2.2 DRAINAGE STRUCTURES

## 2.3 MISCELLANEOUS MATERIALS

### 2.3.1 Concrete

Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for 27.5 MPa concrete under Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 37.5 mm. Air content shall be determined in accordance with ASTM C 231. The

concrete covering over steel reinforcing shall not be less than 25 mm thick for covers and not less than 40 mm thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 75 mm between steel and ground. Expansion-joint filler material shall conform to ASTM D 1751, or ASTM D 1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D 1752.

### 2.3.2 Mortar

Mortar for pipe joints, connections to other drainage structures, and brick or block construction shall conform to ASTM C 270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar but in no case shall exceed 19 liters of water per sack of cement. Water shall be clean and free of harmful acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.

### 2.3.3 Precast Reinforced Concrete Manholes

Precast reinforced concrete manholes shall conform to ASTM C 478M . Joints between precast concrete risers and tops shall be made with flexible watertight, rubber-type gaskets meeting the requirements of paragraph JOINTS.

### 2.3.4 Frame and Cover for Gratings

Frame and cover for gratings shall be cast gray iron, ASTM A 48M , Class 35B; cast ductile iron, ASTM A 536, Grade 65-45-12; or cast aluminum, ASTM B 26/B 26M, Alloy 356.OT6. Weight, shape, size, and waterway openings for grates and curb inlets shall be as indicated on the plans.

### 2.3.5 Joints

#### 2.3.5.1 Flexible Watertight Joints

- a. Materials: Flexible watertight joints shall be made with plastic or rubber-type gaskets for concrete pipe. The design of joints and the physical requirements for plastic gaskets shall conform to AASHTO M 198, and rubber-type gaskets shall conform to ASTM C 443M . Gaskets shall have not more than one factory-fabricated splice, except that two factory-fabricated splices of the rubber-type gasket are permitted if the nominal diameter of the pipe being gasketed exceeds 1.35 m (54 inches).
- b. Test Requirements: Watertight joints shall be tested and shall meet test requirements of paragraph HYDROSTATIC TEST ON WATERTIGHT JOINTS. Rubber gaskets shall comply with the oil resistant gasket requirements of ASTM C 443M. Certified copies of test results shall be delivered to the Contracting Officer before gaskets or jointing materials are installed. Alternate types of watertight joint may be furnished, if specifically approved.

#### 2.3.5.2 PVC Plastic Pipes

Joints shall be solvent cement or elastomeric gasket type in accordance with the specification for the pipe and as recommended by the pipe manufacturer.

#### 2.3.5.3 Corrugated PE Plastic Pipe

Water tight joints shall be made using a PVC or PE coupling and rubber gaskets as recommended by the pipe manufacturer. Rubber gaskets shall conform to ASTM F 477.

#### 2.3.5.4 Profile Wall PE Plastic Pipe

Joints shall be gasketed or thermal weld type with integral bell in accordance with ASTM F 894.

### 2.4 STEEL LADDER

Steel ladder shall be provided where the depth of the manhole exceeds 3.66 m (12 feet). These ladders shall be not less than 406 mm (16 inches) in width, with 19 mm (3/4 inch) diameter rungs spaced 305 mm (12 inches) apart.

The two stringers shall be a minimum 10 mm (3/8 inch) thick and 63 mm (2-1/2 inches) wide. Ladders and inserts shall be galvanized after fabrication in conformance with ASTM A 123/A 123M.

### 2.5 DOWNSPOUT BOOTS

Boots used to connect exterior downspouts to the storm-drainage system shall be of gray cast iron conforming to ASTM A 48M , Class 30B or 35B. Shape and size shall be as indicated.

### 2.6 RESILIENT CONNECTORS

Flexible, watertight connectors used for connecting pipe to manholes and inlets shall conform to ASTM C 923.

### 2.7 HYDROSTATIC TEST ON WATERTIGHT JOINTS

#### 2.7.1 Concrete, PVC and PE Pipe

A hydrostatic test shall be made on the watertight joint types as proposed. Only one sample joint of each type needs testing; however, if the sample joint fails because of faulty design or workmanship, an additional sample joint may be tested. During the test period, gaskets or other jointing material shall be protected from extreme temperatures which might adversely affect the performance of such materials. Performance requirements for joints in reinforced and nonreinforced concrete pipe shall conform to AASHTO M 198 or ASTM C 443M . Test requirements for joints in clay pipe shall conform to ASTM C 425. Test requirements for joints in PVC and PE plastic pipe shall conform to ASTM D 3212.

## PART 3 EXECUTION

### 3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 02316 "Excavation, Trenching, and Backfilling for Utilities Systems" and the requirements specified below.

#### 3.1.1 Removal of Rock

Rock in either ledge or boulder formation shall be replaced with suitable materials to provide a compacted earth cushion having a thickness between unremoved rock and the pipe of at least 200 mm or 13 mm for each meter of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. Where bell-and-spigot pipe is used, the cushion shall be maintained under the bell as well as under the straight portion of the pipe. Rock excavation shall be as specified and defined in Section 02316 "Excavation, Trenching, and Backfilling for Utilities Systems".

#### 3.1.2 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor in his performance of shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the government.

### 3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

#### 3.2.1 Concrete Pipe Requirements

When no bedding class is specified or detailed on the drawings, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform to the lowest one-fourth of the outside portion of circular pipe or to the lower curved portion of pipe arch for the entire length of the pipe or pipe arch. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall be not more than the length, depth, and width required for properly making the particular type of joint.

#### 3.2.2 Plastic Pipe

Bedding for PVC and PE pipe shall meet the requirements of ASTM D 2321. Bedding, haunching, and initial backfill shall be either Class IB or II material.

### 3.3 PLACING PIPE

Each pipe shall be thoroughly examined before being laid; defective or

damaged pipe shall not be used. Plastic pipe shall be protected from exposure to direct sunlight prior to laying, if necessary to maintain adequate pipe stiffness and meet installation deflection requirements. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary. Deflection of installed flexible pipe shall not exceed the following limits:

TYPE OF PIPE	MAXIMUM ALLOWABLE DEFLECTION (%)
Plastic	7.5

Not less than 30 days after the completion of backfilling, the Government may perform a deflection test on the entire length of installed flexible pipe using a mandrel or other suitable device. Installed flexible pipe showing deflections greater than those indicated above shall be retested by a run from the opposite direction. If the retest also fails, the suspect pipe shall be replaced at no cost to the Government.

#### 3.3.1 Concrete, PVC, and Ribbed PVC

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

#### 3.3.2 Corrugated PE Pipe

Laying shall be with the separate sections joined firmly on a bed shaped to line and grade and shall follow manufacturer's recommendations.

#### 3.3.3 Jacking Pipe Through Fills

Methods of operation and installation for jacking pipe through fills shall conform to requirements specified in Volume 1, Chapter 1, Part 4 of AREMA Manual.

### 3.4 JOINTING

#### 3.4.1 Concrete

##### 3.4.1.1 Flexible Watertight Joints

Gaskets and jointing materials shall be as recommended by the particular manufacturer in regard to use of lubricants, cements, adhesives, and other special installation requirements. Surfaces to receive lubricants, cements, or adhesives shall be clean and dry. Gaskets and jointing materials shall be affixed to the pipe not more than 24 hours prior to the installation of the pipe, and shall be protected from the sun, blowing dust, and other deleterious agents at all times. Gaskets and jointing materials shall be

inspected before installing the pipe; any loose or improperly affixed gaskets and jointing materials shall be removed and replaced. The pipe shall be aligned with the previously installed pipe, and the joint pushed home. If, while the joint is being made the gasket becomes visibly dislocated the pipe shall be removed and the joint remade.

### 3.5 DRAINAGE STRUCTURES

#### 3.5.1 Manholes and Inlets

Construction shall be of reinforced concrete, plain concrete, brick, precast reinforced concrete, precast concrete segmental blocks, prefabricated corrugated metal, or bituminous coated corrugated metal; complete with frames and covers or gratings; and with fixed galvanized steel ladders where indicated. Pipe studs and junction chambers of prefabricated corrugated metal manholes shall be fully bituminous-coated and paved when the connecting branch lines are so treated. Pipe connections to concrete manholes and inlets shall be made with flexible, watertight connectors.

#### 3.5.2 Walls and Headwalls

Construction shall be as indicated.

### 3.6 STEEL LADDER INSTALLATION

Ladder shall be adequately anchored to the wall by means of steel inserts spaced not more than 1.83 m (6 feet) vertically, and shall be installed to provide at least 152 mm (6 inches) of space between the wall and the rungs. The wall along the line of the ladder shall be vertical for its entire length.

### 3.7 BACKFILLING

#### 3.7.1 Backfilling Pipe in Trenches

After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 150 mm in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. The fill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation of at least 300 mm above the top of the pipe. The remainder of the trench shall be backfilled and compacted in accordance with Section 02316, "EXCAVATION, TRENCHING, AND BACKFILLING FOR UTILITIES SYSTEMS."

#### 3.7.2 Backfilling Pipe in Fill Sections

For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified below. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 150 mm in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing

normal filling operations, the crown width of the fill at a height of 300 mm above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 4 m, whichever is less. After the backfill has reached at least 300 mm above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted with Section 02316, "EXCAVATION, TRENCHING, AND BACKFILLING."

### 3.7.3 Movement of Construction Machinery

When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

### 3.7.4 Compaction

#### 3.7.4.1 General Requirements

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

#### 3.7.4.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density, which will be determined as specified below.

- a. Under paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.
- b. Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.
- c. Under nontraffic areas, density shall be not less than that of the surrounding material.

### 3.7.5 Determination of Density

Testing shall be the responsibility of the Contractor and performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that



specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D 1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D 2167 or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D 2922 results in a wet unit weight of soil and when using this method ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017 or ASTM D 2922. Test results shall be furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

-- End of Section --

## SECTION 02712

LIME-MODIFIED SUBGRADE  
12/97

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 25	(1996a) Chemical Analysis of Limestone, Quicklime, and Hydrated Lime
ASTM C 50	(1994) Sampling, Inspection, Packing, and Marking of Lime and Limestone Products
ASTM C 110	(1995b) Test Methods for Physical Testing of Quicklime, Hydrated Lime, and Limestone
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 422	(1963; R 1990) Particle-Size Analysis of Soils
ASTM D 1556	(1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes
ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1993) Water Content of Soil and Rock in Place By Nuclear Methods (Shallow Depth)
ASTM D 4318	(1995a) Liquid Limit, Plastic Limit, and

## Plasticity Index of Soils

ASTM E 11

(1995) Wire-Cloth Sieves for Testing Purposes

## 1.2 DEFINITIONS

## 1.2.1 Lime-Modified Subgrade

Lime-Modified Subgrade, as used in this specification, is a mixture of lime and satisfactory in-place or borrow material uniformly blended, wetted, and thoroughly compacted to produce a pavement course which meets the criteria set forth in the plans and this specification.

## 1.2.2 Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated as percent laboratory maximum density.

## 1.3 JOB DESCRIPTION

The work specified consists of the construction of a lime-modified subgrade course. The work shall be performed in accordance with this specification and shall conform to the lines, grades, notes, and typical sections shown in the drawings. Sources of materials shall be selected well in advance of the time when materials will be required in the work.

## 1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

SD-03 Product Data

Equipment, Machines, and Tools; GA-AO

List of proposed equipment to be used in performance of construction work including descriptive data.

SD-06 Test Reports

Field Density

Copies of field control test results within 24 hours after the tests are performed.

## SD-07 Certificates

Lime; GA-AO

Source; GA-AO

Source from which lime is to be obtained with certified mill results showing the lime meets all the requirements as outlined in subparagraph Lime Sources. Lime shall be in accordance with paragraph MATERIALS. Certified copies of test results of materials and sources submitted not less than 30 days before material is required for the work.

## SAMPLING AND TESTING; GA-AO

Sampling and testing shall be performed by an approved commercial testing laboratory or by facilities furnished by the Contractor. Work requiring testing will not be permitted until the facilities have been inspected and approved.

## 1.5 EQUIPMENT, MACHINES, AND TOOLS

## 1.5.1 General Requisites

Equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in satisfactory working condition at all times. Other compacting equipment may be used in lieu of that specified, where it can be demonstrated that the results are equivalent. Protective equipment, apparel, and barriers shall be provided to protect the eyes, respiratory system, and the skin of workers exposed to contact with lime dust or slurry.

## 1.5.2 Pulverizing Equipment

The pulverizing equipment shall be self-propelled, 4 wheel drive and operated by a single operator. It shall be capable of pulverizing in a single pass the existing full depth and 2.44 meters wide. The rotor shall be capable of up or down cutting. It shall be equipped with tap-in, knock-out, bullet-type teeth, all of which are identical.

## 1.5.2 Steel-Wheeled Rollers

Steel-wheeled rollers shall be the self-propelled type with a total weight of not less than 9 metric tons, and a minimum weight of 135 kilograms per millimeter width of rear wheel. Wheels of the rollers shall be equipped with adjustable scrapers. The use of vibratory rollers is optional.

## 1.5.3 Pneumatic-Tired Rollers

Pneumatic-tired rollers shall have 4 or more tires, each loaded to a minimum of 13.6 metric tons and inflated to a minimum pressure of 1.035 MPa. The loading shall be equally distributed to all wheels, and the tires shall be uniformly inflated. Towing equipment shall also be pneumatic-tired.

## 1.5.4 Mechanical Spreader

Mechanical spreader shall be self-propelled or attached to a propelling unit capable of moving the spreader and material truck. The device shall be steerable and shall have variable speeds forward and reverse. The spreader and propelling unit shall be carried on tracks, rubber tires, or drum-type steel rollers that will not disturb the underlying material. The spreader shall contain a hopper, an adjustable screed, and outboard bumper rolls; and shall be designed to have a uniform, steady flow of material from the hopper. The spreader shall be capable of laying material without segregation across the full width of the lane to a uniform thickness and to a uniform loose density so that when compacted, the layer or layers shall conform to thickness and grade requirements indicated. The Contracting Officer may require a demonstration of the spreader prior to approving use in performance of the work.

#### 1.5.5 Sprinkling Equipment

Sprinkling equipment shall consist of tank trucks, pressure distributors, or other approved equipment designed to apply controlled quantities of water uniformly over variable widths of surface.

#### 1.5.6 Tamers

Tamers shall be of an approved mechanical type, operated by either pneumatic pressure or internal combustion, and shall have sufficient weight and striking power to produce the compaction required.

### 1.6 WEATHER LIMITATIONS

Work on the base course shall not be performed during freezing temperatures.

When the temperature is below 5 degrees C, the completed base course shall be protected against freezing by a sufficient covering of straw, or by other approved methods, until the course has dried out. Any areas of completed base course that are damaged by freezing, rainfall, or other weather conditions shall be brought to a satisfactory condition without additional cost to the Government. Lime shall not be applied when the atmospheric temperature is less than 5 degrees C. No lime shall be applied to soils that are frozen or contain frost, or when the underlying material is frozen.

If the temperature falls below 2 degrees C, completed lime-treated areas shall be protected against any detrimental effects of freezing.

## PART 2 PRODUCTS

### 2.1 MATERIALS

#### 2.1.1 Lime

Lime shall be a hydrated or granular quicklime conforming to the following requirements, however granular quicklime shall be delivered to the jobsite as a slurry.

##### 2.1.1.1 Hydrated Lime

Hydrated lime for this purpose shall be any hydrated lime product consisting

of hydrated lime and insoluble inert material and conforming to the following as to chemical composition and residue: 90% minimum available Lime Index as Calcium Hydroxide,  $\text{CA}(\text{OH})_2$ ; 1% maximum residue retained on a 600 um sieve; and 2% maximum residue retained on a 75 um sieve.

#### 2.1.1.2 Granular Quicklime

Granular quicklime is a calcined material, the major part of which is calcium oxide or calcium oxide in natural association with a lesser amount of magnesium oxide capable of slaking with water. This specification applies specifically to limes made from calcium-type limestones. When tested under the appropriate methods of test, the lime shall conform to the following requirements: Not less than 90% minimum available lime index as Calcium Oxide ( $\text{CaO}$ ); Fineness (Dry Sieve) - 5% maximum retained on a 16 mm sieve, 75% minimum retained on a 425 um sieve, 96% minimum retained on a 75 um sieve; and Residue after slaking (wet sieve) - 5% maximum retained on a 850 um sieve.

#### 2.1.2 Material to be Stabilized

Material to be modified shall consist of satisfactory material. Satisfactory material shall comprise any materials classified by ASTM D 2487 as GP, GM, SC, SW, SM, ML, CL or CH. Unsatisfactory materials shall comprise any materials classified by ASTM D 2487 as Pt, OH, OL or MH

#### 2.1.3 Water

Water shall be clean, fresh, and free from injurious amounts of oil, acid, salt, alkali, organic matter, and other substances deleterious to the lime or soil-lime mixture, and shall be subject to approval.

### PART 3 EXECUTION

#### 3.1 LIME STABILIZATION MIXTURE

The Contractor shall construct a working platform for new pavement construction by lime-modifying the subgrade soil. To accomplish this, the Contractor shall incorporate a minimum of 8 percent hydrated lime by weight (based on oven-dry weight of the soil) or a minimum 6 percent granular quicklime by weight (based on oven-dry weight of the soil) to the minimum depth shown on the drawings below top of subgrade. The material to be stabilized shall be thoroughly pulverized and, when lime is applied in the dry state, the mix shall be thoroughly blended at a moisture content below optimum. After blending, water shall be blended into the dry mix in amounts necessary to bring the moisture content to optimum. Field moisture content shall be controlled within plus or minus 2 percent of optimum. When the modified subgrade is constructed in more than one layer, the previously constructed layer shall be cleaned of loose and foreign matter by sweeping with power sweeper or power brooms except that hand brooms may be used in areas where power cleaning is not practicable. Adequate drainage shall be provided during the entire construction period to prevent water from collecting or standing on the area to be stabilized or on pulverized, mixed, or partially mixed material. Line and grade stakes shall be provided as

necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

### 3.2 PREPARATION OF AREA TO BE MODIFIED

After pavement and subgrade excavation, the area to be modified shall be cleaned of debris. The area will be inspected for adequate compaction and shall be capable of withstanding, without displacement, the compaction specified for the soil-lime mixture. Debris and removed unsatisfactory in-place material shall be disposed of as specified.

#### 3.2.1 In-Place Material to be Modified

The entire area shall be graded to conform to the lines, grades, and cross sections shown in the plans prior to being processed. Soft, yielding areas and ruts or other irregularities in the surface shall be corrected. The material in the affected areas shall be loosened and unsatisfactory material removed. The area shall then be shaped to line, grade, and cross section, and shall be compacted to the specified density.

### 3.2 Grade Control

Underlying material shall be excavated to sufficient depth for the required stabilized-course thickness so that the finished stabilized course with the subsequent surface course will meet the fixed grade. Finished and completed stabilized area shall conform to the lines, grades, cross section, and dimensions indicated.

### 3.3 INSTALLATION

#### 3.3.1 Mixed In-Place Method

##### 3.3.1.1 Scarifying and Pulverizing of Soil

Prior to application of lime, the soil shall be scarified and pulverized to a sufficient width and depth to obtain a uniform mixture of soil, lime and water and to form a compacted lime-treated course conforming to the cross section indicated. Scarification shall be controlled so that the layer beneath the layer to be treated is not disturbed. Depth of pulverizing shall not exceed the depth of scarification.

##### 3.3.1.2 Application of Lime

Pulverized material shall be shaped to approximately the cross section indicated. Lime shall be applied so that when uniformly mixed with the soil, the specified lime content is obtained, and a sufficient quantity of lime-treated soil is produced to construct a compacted lime-treated course conforming to the lines, grades, and cross section indicated. Mechanical spreaders shall be used in applying bulk lime. Distributors shall be used in applying slurry. If lime is spread by hand, the bags shall be spotted accurately on the area being stabilized so that when the bags are opened the lime will be dumped and spread uniformly on the area being processed. No equipment except that used in spreading and mixing shall pass over the

freshly applied lime.

#### 3.3.1.3 Initial Mixing

Immediately after the lime has been distributed, the lime and soil shall be mixed. Initial mixing shall be sufficient to alleviate any dusting or wetting of the lime that might occur in the event of wind or rainstorms. This may be accomplished several days in advance of the final application and mixing.

#### 3.3.1.4 Water Application and Moist Mixing

Moisture content of the mixture shall be determined in preparation for final mixing. Moisture in the mixture following final mixing shall not be less than the water content determined to be optimum based on dry weight of soil and shall not exceed the optimum water content by more than 2 percentage points. Water may be added in increments as large as the equipment will permit; however, such increment of water shall be partially incorporated in the mix to avoid concentration of water near the surface. After the last increment of water has been added, mixing shall be continued until the water is uniformly distributed throughout the full depth of the mixture, including satisfactory moisture distribution along the edges of the section.

#### 3.3.2 Edges of Modified Course

Approved material shall be placed along the edges of the stabilized course in a quantity that will compact to the thickness of the course being constructed, or to the thickness of each layer in a multiple-layer course, allowing at least a 300 mm width of the shoulder to be rolled and compacted simultaneously with the rolling and compacting of each layer of the stabilized course.

#### 3.3.3 Layer Thickness

After final mixing the material shall be compacted in lift thicknesses no more than 200 mm or less than 75 mm. If the minimum density cannot be obtained throughout the entire lift, the Contractor will be required to construct the layer in two or more lifts.

#### 3.3.4 Compaction

Before compaction operations are started and as a continuation of the mixing operation, the mixture shall be thoroughly loosened and pulverized to the full depth. Compaction shall be started immediately after mixing is completed. During final compaction, the surface shall be moistened, if necessary, and shaped to the required lines, grades, and cross section. The density of the compacted soil-lime mixture for the full thickness of the modification shall be at least the maximum laboratory density obtained by the test procedure presented in ASTM D 1557. The maximum laboratory density shall be determined after the lime and water have been mixed into the subgrade and cured for at least 24 hours. The subgrade density of the compacted mixture shall be at least 90 percent of laboratory maximum density for rigid pavement and 95 percent of laboratory maximum density for flexible pavement. Rolling shall begin at the outside edge of the surface and



proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. At all times, the speed of the roller shall not cause displacement of the mixture to occur. Areas inaccessible to the rollers shall be compacted with mechanical tampers, and shall be shaped and finished by hand methods.

#### 3.3.5 Finishing

The surface of the top layer shall be finished to the grade and cross section shown. The surface shall be of uniform texture. Light blading during rolling may be necessary for the finished surface to conform to the lines, grades, and cross sections. If the surface for any reason becomes rough, corrugated, uneven in texture, or traffic-marked prior to completion, the unsatisfactory portions shall be scarified, reworked, relaid, or replaced as directed. If any portion of the course, when laid, becomes watersoaked for any reason, that portion shall be removed immediately, and the mix placed in a windrow and aerated until a moisture content within the limits specified is obtained; and then spread, shaped, and rolled as specified above.

#### 3.3.6 Construction Joints

At the end of each phase of construction, a straight transverse construction joint shall be formed by cutting back into the completed work to form a true vertical face free of loose or shattered material. Material along construction joints not properly compacted shall be removed and replaced with soil-lime mixture that is mixed, moistened, and compacted as specified.

#### 3.3.7 Curing and Protection

Immediately after the soil-lime area has been finished as specified above, the surface shall be protected against rapid drying for 7 days by moist curing. The modified area shall be protected from freezing during the curing period or until hardened, whichever is longer.

##### 3.3.7.1 Moist Curing

The area shall be moistened by sprinkling and shall be kept moist for the 7-day curing period.

### 3.4 SAMPLING AND TESTING

#### 3.4.1 General Requirements

Sampling and testing shall be performed by an approved commercial testing laboratory or by facilities furnished by the Contractor. Work requiring testing will not be permitted until the facilities have been inspected and approved. The first inspection will be at the expense of the Government. Cost incurred for any subsequent inspection required because of failure of the facilities to pass the first inspection will be charged to the Contractor. Tests shall be performed in sufficient numbers and at the locations and times directed to ensure that materials and compaction meet

specified requirements. Certified copies of the test results shall be furnished to the Contracting Officer.

#### 3.4.2 Results

Results shall verify that the material complies with the specification. When deficiencies are found, the initial analysis shall be repeated and the material already placed shall be retested to determine the extent of unacceptable material. All in-place unacceptable material shall be replaced.

#### 3.4.3 Sampling

Samples of lime shall be taken in accordance with ASTM C 50. During actual construction, no substitution shall be made in the materials which were used in the verification tests without additional verification testing similar to the original verification tests.

#### 3.4.4 Sieve Analysis

Before starting work, one sample of material to be stabilized shall be tested in accordance with ASTM C 136 and ASTM D 422 on sieves conforming to ASTM E 11. After the initial test, a minimum of one analysis shall be performed for each 1000 metric tons of material placed, with a minimum of three analyses for each day's run until the course is completed.

#### 3.4.5 Liquid Limit and Plasticity Index

One liquid limit and plasticity index shall be performed for each sieve analysis. Liquid limit and plasticity index shall be in accordance with ASTM D 4318.

#### 3.4.6 Lime Source

The source from which the lime is to be obtained shall be designated by the Contractor. The Contractor shall furnish certified mill results at least 30 days prior to the use of the lime. The certified mill results shall show that the lime meets all requirements specified herein. Lime shall be tested for the specified chemical and physical requirements in accordance with ASTM C 25 and ASTM C 110, respectively.

#### 3.4.7 Density-Moisture Determinations

Tests for determination of maximum density and optimum moisture shall be the responsibility of the Contractor in accordance with the requirements of ASTM D 1557. Samples shall be representative of the materials to be placed. An optimum moisture-density curve shall be obtained for each principal type of materials or combination of materials encountered or utilized. Results of these tests shall be the basis of control for compaction. The density-moisture determination shall include Atterberg limits, grain size determinations and specific gravity.

#### 3.4.7 Verification Tests

During construction of the lime-modified subgrade, the Contractor shall

verify the application rate and depth of stabilization.

### 3.5 FIELD QUALITY CONTROL

Tests shall provide a moisture-density relationship for the lime-soil mixture. Results of field quality control testing shall verify that materials comply with this specification. When deficiencies are found, the initial analysis shall be repeated and the material already placed shall be retested to determine the extent of unacceptable material. All in-place unacceptable material shall be replaced or repaired, as directed by the Contracting Officer, at no additional cost to the Government.

#### 3.5.1 Thickness Control

Completed thicknesses of the modified subgrade shall be within 13 mm of the thickness indicated. Where the measured thickness of the modified subgrade is more than 13 mm deficient, such areas shall be corrected by scarifying, adding mixture of proper gradation, reblading, and recompact as directed.

Where the measured thickness of the stabilized course is more than 13 mm thicker than indicated, it shall be considered as conforming to the specified thickness requirement. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 6 mm of the thickness indicated. Thickness of the stabilized course shall be measured at intervals which ensure one measurement for each 400 square meters of stabilized course. Measurements shall be made in 75 mm diameter test holes penetrating the stabilized course.

#### 3.5.2 Field Density

Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167 or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked, and adjusted if necessary, using the sand cone method as described in paragraph Calibration of the ASTM publication. ASTM D 2922 results in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017. If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 at least once per lift for each 840 square meter of stabilized material. Calibration curves and calibration tests results shall be furnished to the Contracting Officer within 24 hours of conclusion of the tests. At least one field density test shall be performed for each 250 square meters of each layer of base material.

### 3.6 TRAFFIC

Completed portions of the lime-treated soil area may be opened immediately to light traffic provided the curing is not impaired. After the curing period has elapsed, completed areas may be opened to all traffic, provided the stabilized course has hardened sufficiently to prevent marring or distorting of the surface by equipment or traffic. Heavy equipment shall not be permitted on the area during the curing period. Lime and water may be hauled over the completed area with pneumatic-tired equipment if approved. Finished portions of lime-stabilized soil that are traveled on by

equipment used in constructing an adjoining section shall be protected in a manner to prevent equipment from marring or damaging completed work.

### 3.7 MAINTENANCE

The modified area shall be maintained in a satisfactory condition until the completed work is accepted. Maintenance shall include immediate repairs of any defects, as determined by the Contracting Officer, and shall be repeated as often as necessary to keep the area intact. Defects shall be corrected as stated herein.

### 3.8 DISPOSAL OF UNSATISFACTORY MATERIALS

Removed in-place materials that are unsuitable for stabilization, material that is removed for the required correction of defective areas, waste material, and debris shall be disposed of as directed by the Contracting Officer.

-- End of Section --

## SECTION 02714

## DRAINAGE LAYER

12/97

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO T 102 (1983; R 1996) Spot Test of Asphaltic  
Materials

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29/C 29M (1997) Bulk Density ("Unit Weight") and Voids  
in Aggregate

ASTM C 88 (1999a) Soundness of Aggregates by Use of  
Sodium Sulfate or Magnesium Sulfate

ASTM C 117 (1995) Materials Finer Than 75 micrometer  
(No. 200) Sieve in Mineral Aggregates by  
Washing

ASTM C 131 (1996) Resistance to Degradation of  
Small-Size Coarse Aggregate by Abrasion and  
Impact in the Los Angeles Machine

ASTM C 136 (1996a) Sieve Analysis of Fine and Coarse  
Aggregates

ASTM C 150 (1999a) Portland Cement

ASTM C 595 (1998) Blended Hydraulic Cements

ASTM C 595M (1997) Blended Hydraulic Cements (Metric)

ASTM D 5 (1997) Penetration of Bituminous Materials

ASTM D 75 (1987; R 1997) Sampling Aggregates

ASTM D 140 (1998) Sampling Bituminous Materials

ASTM D 946 (1999) Penetration-Graded Asphalt Cement for

## Use in Pavement Construction

ASTM D 1250	(1980; R 1997el) Petroleum Measurement Tables
ASTM D 1856	(1995a) Recovery of Asphalt From Solution By Abson Method
ASTM D 2172	(1995) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D 2487	(1998) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996el) Water Content of Soil and Rock In Place by Nuclear Methods (Shallow Depth)
ASTM D 3381	(1999) Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 4791	(1999) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregates
ASTM E 548	(1994el) General Criteria Used for Evaluating Laboratory Competence

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

## SD-06 Test Reports

Sampling and Testing; GA-AO

Copies of field test results within 24 hours of completion of tests.

Approval of Materials; GA-AO

Material sources and material test results prior to field use.

Evaluation; GA-AO

Test section construction report.

### 1.3 SYSTEM DESCRIPTION

The Contractor shall build a drainage layer under the streets airfield pavements as indicated and in accordance with the following subparagraphs:

#### 1.3.1 Aggregate Drainage Layer

A drainage layer consisting of rapid draining materials (RDM).

### 1.4 FIELD COMPACTION

Field compaction requirements shall be based on the results of a test section constructed by the Contractor, using the materials, methods, and equipment proposed for use in the work. The test section shall meet the requirements of paragraph TEST SECTION.

### 1.5 EQUIPMENT

#### 1.5.1 General Requirements

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times.

#### 1.5.2 Placement Equipment

An asphalt paving machine shall be used to place drainage layer material. Alternate methods may be used if it can be demonstrated in the test section that these methods obtain the specified results.

#### 1.5.3 Compaction Equipment

A dual or single smooth drum roller which provides a maximum compactive effort without crushing the drainage layer aggregate shall be used to compact drainage layer material.

### 1.6 WEATHER LIMITATION

Drainage layer material shall be placed when the atmospheric temperature is above 2 degrees C. Areas of completed drainage layer or underlying courses that are damaged by freezing, rainfall, or other weather conditions or by contamination from sediments, dust, dirt, or foreign material shall be corrected by the Contractor to meet specified requirements.

### 1.7 SAMPLING AND TESTING

#### 1.7.1 General Requirements

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved commercial testing

laboratory, or by the Contractor subject to approval. If the Contractor elects to establish testing facilities of his own, approval of such facilities shall be based on compliance with ASTM E 548, and no work requiring testing will be permitted until the Contractor's facilities have been inspected and approved. The first inspection of the facilities will be at the expense of the Government and any subsequent inspections required because of failure of the first inspection shall be at the expense of the Contractor. Such costs will be deducted from the total amount due the Contractor. Drainage layer materials shall be tested to establish compliance with the specified requirements.

#### 1.7.2 Sampling

Aggregate samples shall be taken in accordance with ASTM D 75. Bituminous samples shall be taken in accordance with ASTM D 140. Bituminous or cement stabilized mixture samples shall be taken using methods approved by the Contracting Officer.

#### 1.7.3 Test Methods

##### 1.7.3.1 Sieve Analyses

Sieve analyses shall be made in accordance with ASTM C 117 and ASTM C 136.

##### 1.7.3.2 Density Tests

Field density tests shall be made in accordance with ASTM D 2922. When using this method, ASTM D 3017 shall be used to determine the moisture content of the aggregate drainage layer material. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph "Calibration" of ASTM D 2922, on each different type of material being tested at the beginning of a job and at intervals as directed by the Contracting Officer.

##### 1.7.3.3 Soundness Test

Soundness tests shall be made in accordance with ASTM C 88.

##### 1.7.3.4 Los Angeles Abrasion Test

Los Angeles abrasion tests shall be made in accordance with ASTM C 131.

##### 1.7.3.5 Flat or Elongated Particles Tests

Flat and/or elongated particles tests shall be made in accordance with ASTM D 4791.

##### 1.7.3.6 Fractured Faces Tests

When aggregates are supplied from crushed gravel, approved test methods shall be used to assure the aggregate meets the requirements for fractured faces in paragraph AGGREGATES.



#### 1.7.4 Testing Frequency

##### 1.7.4.1 Aggregate Layer

Sieve analyses, field density, and moisture content tests shall be performed at a rate of at least one test for every 300 square meters of completed area and not less than one test for each day's production. Soundness tests, Los Angeles abrasion tests, fractured faces tests and flat and/or elongated particles tests shall be performed at the rate of one test for every 10 sieve analysis tests.

#### 1.7.5 Approval of Materials

##### 1.7.5.1 Aggregate

The aggregate source shall be selected at least 90 days prior to field use in the test section. Tentative approval of the source will be based on certified test results to verify that materials proposed for use meet the contract requirements. Final approval of both the source and the material will be based on test section performance and tests for gradation, soundness, Los Angeles abrasion, flat and/or elongated particles tests and fractured faces tests. For aggregate drainage layer materials, these tests shall be performed on samples taken from the completed and compacted drainage layer course within the test section. For bituminous or cement stabilized drainage layer material, these tests shall be performed on aggregate samples taken prior to addition of bituminous or cementitious material and subsequent placement in the test section.

## PART 2 PRODUCTS

### 2.1 AGGREGATES

Aggregates shall consist of clean, sound, hard, durable, angular particles of crushed stone, crushed slag, or crushed gravel which meet the specification requirements. Slag shall be an air-cooled, blast-furnace product having a dry weight of not less than 1040 kg per cubic meter determined by ASTM C 29/C 29M. The aggregates shall be free of silt and clay as defined by ASTM D 2487, vegetable matter, and other objectionable materials or coatings.

#### 2.1.1 Aggregate Quality

The aggregate shall have a soundness loss not greater than 18 percent weighted averaged at 5 cycles when tested in magnesium sulfate in accordance with ASTM C 88. The aggregate shall have a percentage of loss on abrasion not to exceed 40 after 500 revolutions as determined by ASTM C 131. The percentage of flat and/or elongated particles shall be determined by ASTM D 4791 with the following modifications. The aggregates shall be separated into 2 size fractions. Particles greater than 12.5 mm sieve and particles passing the 12.5 mm sieve and retained on the 4.75 mm sieve. The percentage of flat and/or elongated particles in either fraction shall not exceed 20. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than

3. When the aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements. When the aggregate is supplied from crushed gravel it shall be manufactured from gravel particles, 90 percent of which by weight are retained on the maximum-size sieve listed in TABLE I. In the portion retained on each sieve specified, the crushed gravel shall contain at least 90 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the face. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as 2 fractured faces.

#### 2.1.2 Gradation Requirements

Drainage layer aggregates shall be well graded within the limits specified in TABLE I.

TABLE I. GRADATION OF DRAINAGE LAYER MATERIAL

Percentage by Weight Passing Square-Mesh Sieve

Sieve	Rapid Draining
Designation	Material (RDM)
37.50 mm	100
25.00 mm	70-100
19.00 mm	55-100
12.50 mm	40-80
9.50 mm	30-65
4.75 mm	10-50
2.36 mm	0-25
1.18 mm	0-5

NOTE 1: Particles having diameters less than 0.02 mm shall not be in excess of 1.5 percent by weight of the total sample tested.

NOTE 2: The values are based on aggregates of uniform specific gravity, and the percentages passing the various sieves may require appropriate correction by the Contracting Officer when aggregates of varying specific gravities are used.

NOTE 4: For RDM, the coefficient of uniformity (CU) shall be greater than 3.5. (CU = D60/D10).

#### 2.2 CEMENTITIOUS MATERIALS

Portland cement to be mixed with aggregates shall conform to ASTM C 150, Type I, IA, II or IIA ASTM C 595M, Type IS or IS (A).

#### 2.3 BITUMINOUS OR CEMENT STABILIZED JOB-MIX FORMULA

The bituminous stabilized mix shall consist of a mixture of OGM and a minimum of 2 percent asphalt cement by weight. Tolerances for bituminous stabilized material shall be maintained for field production at plus or

minus 0.25 percent for asphalt cement and plus or minus 14 degrees C for mixing temperatures. The cement stabilized mix shall consist of OGM and a minimum of 90 kg of portland cement per cubic meter with a water/cement ratio of 0.37. Based on the test section performance, the Contractor shall be responsible for adjustments (increases) in asphalt cement or portland cement quantities to ensure the stabilized drainage layer will not rut or be disturbed by the Contractor's proposed paving method. The Contractor shall submit a job-mix formula (JMF) with the test section report for Contracting Officer approval.

### PART 3 EXECUTION

#### 3.1 STOCKPILING AGGREGATES

Aggregates shall be stockpiled at locations designated by the Contracting Officer. Stockpile areas shall be cleared and leveled prior to stockpiling aggregates. Aggregates shall be stockpiled to prevent segregation and contamination. Aggregates obtained from different sources shall be stockpiled separately.

#### 3.2 TEST SECTION

##### 3.2.1 Data

A test section shall be constructed to evaluate the ability to carry traffic and the constructability of the drainage layer including required mixing, placement, and compaction procedures. Test section data will be used by the Contracting Officer to determine the required number of passes and the field dry density requirements for full scale production.

##### 3.2.2 Scheduling

The test section shall be constructed a minimum of 30 days prior to the start of full scale production to provide sufficient time for an evaluation of the proposed materials, equipment and procedures including Government QA testing.

##### 3.2.3 Location and Size

The test section shall be placed outside the production paving limits in an area with similar subgrade and subbase conditions approved by the Contracting Officer. The underlying courses and subgrade preparation, required for the pavement section, shall be completed, inspected and approved in the test section prior to constructing the drainage layer. The test section shall be a minimum of 30 m long and one full paving lane wide.

##### 3.2.4 Initial Testing

Certified test results, to verify that the materials proposed for use in the test section meet the contract requirements, shall be provided by the Contractor and approved by the Contracting Officer prior to the start of the test section.

##### 3.2.5 Mixing, Placement, and Compaction

Mixing, placement, and compaction shall be accomplished using equipment meeting the requirements of paragraph EQUIPMENT. Compaction equipment speed shall be no greater than 2.4 km/hour.

### 3.2.6 Procedure

#### 3.2.6.1 Aggregate Drainage Layer Tests

The test section shall be constructed with aggregate in a moist state so as to establish a correlation between number of roller passes and dry density achievable during field production. Density and moisture content tests shall be conducted at the surface and at intervals of 50 mm of depth down for the total layer thickness, in accordance with ASTM D 2922 and ASTM D 3017.

Sieve analysis tests shall be conducted on composite samples, taken adjacent to the density test locations, which represent the total layer thickness. One set of tests (i.e. density, moisture, and sieve analysis) shall be taken before compaction and after each subsequent compaction pass at three separate locations as directed by the Contracting Officer. Compaction passes and density readings shall continue until the difference between the average dry densities of any two consecutive passes is less than or equal to 8 kg per cubic meter (0.5 pcf). If choke stone is used to stabilize the surface of OGM, the choke stone shall be placed after compaction of the final lift of OGM. The choke stone shall be spread in a thin layer no thicker than 13 mm and worked into the surface of the OGM using two passes of a vibratory roller and wetting. The test section shall be completed by making one final pass with the roller in the static mode and observing any change in the drainage layer surface texture.

### 3.2.7 Evaluation

Within 10 days of completion of the test section, the Contractor shall submit to the Contracting Officer a Test Section Construction Report complete with all required test data and correlations. The Contracting Officer will evaluate the data and provide to the Contractor the required number of passes of the roller, the dry density for field density control during construction, the depth at which to check the density, and the need for a final static pass of the roller.

### 3.3 PREPARATION OF UNDERLYING COURSE

Prior to constructing the drainage layer, the underlying course shall be cleaned of all foreign materials. During construction, the underlying course shall contain no frozen material. The underlying course shall conform to Section 02721 SUBBASE COURSES. Ruts or soft yielding spots in the underlying courses having inadequate compaction and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line, and grade, and recompacting to specified density. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the drainage layer is placed.

### 3.4 TRANSPORTING MATERIAL

### 3.4.1 Aggregate Drainage Layer Material

Aggregate drainage layer material shall be transported to the site in a manner which prevents segregation and contamination of materials.

## 3.5 PLACING

### 3.5.1 General Requisites

Drainage layer material shall be placed on the underlying course in lifts of uniform thickness using equipment meeting the requirements of paragraph EQUIPMENT. When a compacted layer 150 mm or less in thickness is required, the material shall be placed in a single lift. When a compacted layer in excess of 150 mm is required, the material shall be placed in lifts of equal thickness. No lift shall exceed 150 mm or be less than 75 mm when compacted. The lifts when compacted after placement shall be true to the grades or levels required with the least possible surface disturbance. Where the drainage layer is placed in more than one lift, the previously constructed lift shall be cleaned of loose and foreign material. Such adjustments in placing procedures or equipment shall be made to obtain true grades and minimize segregation and degradation of the drainage layer material. Choke stone used to stabilize the surface of the OGM shall be spread in a thin layer no thicker than 13 mm.

### 3.5.2 Hand Spreading

In areas where machine spreading is impractical, drainage layer material shall be spread by hand. The material shall be spread uniformly in a loose layer to prevent segregation. The material shall conform to the required grade and thickness after compaction.

## 3.6 COMPACTION REQUIREMENTS

Compaction shall be accomplished using rollers meeting the requirements of paragraph EQUIPMENT and operating at a rolling speed of no greater than 2.4 km per hour. Each lift of drainage material, including shoulders when specified under the shoulders, shall be compacted with the number of passes of the roller as specified by the Contracting Officer. In addition, a minimum field dry density, as specified by the Contracting Officer, shall be maintained. If the required field dry density is not obtained, the number of roller passes shall be adjusted in accordance with paragraph DEFICIENCIES. Excessive rolling resulting in crushing of aggregate particles shall be avoided. Choke stone used to stabilize the surface of the OGM shall be worked into the surface of the OGM by two passes of a vibratory roller and wetting. Compaction of bituminous stabilized material shall begin immediately when the material has cooled to 77 degrees C. Not more than 30 minutes shall elapse between the start of moist mixing of cement stabilized material and the start of field compaction and field compaction shall be completed within 60 minutes. In all places not accessible to the rollers, the drainage layer material shall be compacted with mechanical hand operated tampers.

## 3.7 FINISHING

The top surface of the drainage layer shall be finished after final compaction as determined from the test section. Adjustments in rolling and finishing procedures shall be made to obtain grades and minimize segregation and degradation of the drainage layer material.

### 3.8 EDGES OF DRAINAGE LAYER

Shoulder material shall be placed along the edges of the drainage layer course in a quantity that will compact to the thickness of the layer being constructed. When the drainage layer is being constructed in 2 or more lifts, at least a 300 mm width of the shoulder shall be rolled and compacted simultaneously with the rolling and compacting of each lift of the drainage layer.

### 3.9 SMOOTHNESS TEST

The surface of the top lift shall not deviate more than 10 mm when tested with a 3.05 m straightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding 10 mm shall be corrected in accordance with paragraph DEFICIENCIES.

### 3.10 THICKNESS CONTROL

The completed thickness of the drainage layer shall be within 13 mm of the thickness indicated. Thickness shall be measured at intervals providing at least one measurement for each 500 square meters of drainage layer. Measurements shall be made in test holes at least 75 mm in diameter. Where the measured thickness is more than 13 mm deficient, such areas shall be corrected in accordance with paragraph DEFICIENCIES. Where the measured thickness is 13 mm more than indicated, it will be considered as conforming to the requirements plus 13 mm, provided the surface of the drainage layer is within 13 mm of established grade. The average job thickness shall be the average of all job measurements as specified above but within 8 mm of the thickness shown on the drawings.

### 3.11 DEFICIENCIES

#### 3.11.1 Grade and Thickness

Deficiencies in grade and thickness shall be corrected so that both grade and thickness tolerances are met. Thin layers of material shall not be added to the top surface of the drainage layer to meet grade or increase thickness. If the elevation of the top of the drainage layer is more than 13 mm above the plan grade it shall be trimmed to grade and finished in accordance with paragraph FINISHING. If the elevation of the top surface of the drainage layer is 13 mm or more below the required grade, the surface of the drainage layer shall be scarified to a depth of at least 75 mm, new material shall be added, and the layer shall be blended and recompacted to bring it to grade. Where the measured thickness of the drainage layer is more than 13 mm deficient, such areas shall be corrected by excavating to the required depth and replaced with new material to obtain a compacted lift thickness of at least 75 mm. The depth of required excavation shall be controlled to keep the final surface elevation within grade requirements and

to preserve layer thicknesses of materials below the drainage layer.

#### 3.11.2 Density

Density shall be considered deficient if the field dry density test results are below the dry density specified by the Contracting Officer. If the densities are deficient, the layer shall be rolled with 2 additional passes of the specified roller. If the dry density is still deficient, work will be stopped until the cause of the low dry densities can be determined by the Contracting Officer.

#### 3.11.3 Smoothness

Deficiencies in smoothness shall be corrected as if they are deficiencies in grade or thickness. All tolerances for grade and thickness shall be maintained while correcting smoothness deficiencies.

-- End of Section --

## SECTION 02721

## SUBBASE COURSES

03/97

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO T 180 (1997) Moisture-Density Relations of Soils  
Using a 4.54-kg (10-lb) Rammer and an 457-mm  
(18-in) Drop

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29/C 29M (1997) Bulk Density ("Unit Weight") and Voids  
in Aggregates

ASTM C 117 (1995) Materials Finer Than 75 micrometer  
(No. 200) Sieve in Mineral Aggregates by  
Washing

ASTM C 131 (1996) Resistance to Degradation of  
Small-Size Coarse Aggregate by Abrasion and  
Impact in the Los Angeles Machine

ASTM C 136 (1996) Sieve Analysis of Fine and Coarse  
Aggregates

ASTM D 75 (1987; R 1997) Sampling Aggregates

ASTM D 422 (1963; R 1998) Particle-Size Analysis of Soils

ASTM D 1556 (1990; R 1996el) Density and Unit Weight of  
Soil in Place by the Sand-Cone Method

ASTM D 1557 (1998) Laboratory Compaction Characteristics  
of Soil Using Modified Effort (56,000  
ft-lbf/cu. ft. (2,700 kN-m/cu.m.))

ASTM D 2167 (1994) Density and Unit Weight of Soil in  
Place by the Rubber Balloon Method

ASTM D 2487 (1998) Classification of Soils for Engineering



## Purposes (Unified Soil Classification System)

ASTM D 2922	(1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(1998) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM E 11	(1995) Wire-Cloth Sieves for Testing Purposes

## 1.2 PAYMENT

Payment shall be lump-sum.

## 1.3 DEGREE OF COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 . In this specification, degree of compaction shall be a percentage of laboratory maximum density.

## 1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

## SD-03 Product Data

Equipment.

List of proposed equipment to be used in performance of construction work, including descriptive data.

## SD-06 Test Reports

Sampling and Testing

Copies of initial and in-place test results.

## 1.5 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved testing laboratory in

accordance with Section 01451 CONTRACTOR QUALITY CONTROL. Tests shall be performed at the specified frequency. No work requiring testing will be permitted until the testing laboratory has been inspected and approved. The materials shall be tested to establish compliance with the specified requirements.

#### 1.5.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

#### 1.5.2 Tests

##### 1.5.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with ASTM C 117 and ASTM C 136 .

##### 1.5.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

##### 1.5.2.3 Moisture-Density Determinations

The maximum density and optimum moisture shall be determined in accordance with ASTM D 1557 .

##### 1.5.2.4 Density Tests

Density shall be field measured in accordance with ASTM D 2922. The calibration curves shall be checked and adjusted, if necessary, using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D 2922 result in a wet unit weight of soil and, when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration, in ASTM D 2922, on each different type of material to be tested at the beginning of a job and at intervals as directed.

##### 1.5.2.5 Wear Test

Wear tests shall be made on subbase course material in conformance with ASTM C 131.

##### 1.5.2.6 Weight of Slag

Weight per cubic meter of slag shall be determined in accordance with ASTM C 29/C 29M on the subbase course material.

#### 1.5.3 Testing Frequency

#### 1.5.3.1 Initial Tests

One of each of the following tests shall be performed on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements prior to installation.

- a. Sieve Analysis including 0.02 mm size material
- b. Liquid limit and plasticity index moisture-density relationship
- c. Wear
- d. Weight per cubic meter of Slag

#### 1.5.3.2 In-Place Tests

One of each of the following tests shall be performed on samples taken from the placed and compacted subbase course. Samples shall be taken for each 1000 square meters of each layer of material placed in each area.

- a. Sieve Analysis including 0.02 mm size material
- b. Field Density
- c. Moisture liquid limit and plasticity index

#### 1.5.4 Approval of Material

The source of the material shall be selected 90 days prior to the time the material will be required in the work. Approval of the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and compacted subbase course.

#### 1.6 WEATHER LIMITATIONS

Construction shall be done when the atmospheric temperature is above 2 degrees C. When the temperature falls below 2 degrees C, the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

#### 1.7 EQUIPMENT

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

##### 2.1.1 Subbase Course

Aggregates shall consist of crushed stone or slag, gravel, shell, sand, or other sound, durable, approved materials processed and blended or naturally combined. Aggregates shall be durable and sound, free from lumps and balls

of clay, organic matter, objectionable coatings, and other foreign material. Material retained on the 4.75 mm sieve shall have a percentage of wear not to exceed 50 percent after 500 revolutions when tested as specified in ASTM C 131. Aggregate shall be reasonably uniform in density and quality. Slag shall be an air-cooled, blast-furnace product having a dry weight of not less than 1050 kg/cubic meter. Aggregates shall have a maximum size of 25 mm and shall be within the limits specified as follows:

Maximum Allowable Percentage by Weight  
Passing Square-Mesh Sieve

Sieve Designation	No. 1	No. 2	No. 3	No. 4
2 mm	50	80	--	85
0.075 mm	15	15	15	15

Particles having diameters less than 0.02 mm shall not be in excess of 3 percent by weight of the total sample tested as determined in accordance with ASTM D 422. The portion of any blended component and of the completed course passing the 0.425 mm shall be either nonplastic or shall have a liquid limit not greater than 25 and a plasticity index not greater than 5.

#### 2.1.2 Select-Material Subbase Course

Materials shall consist of selected soil or other materials from field excavation, stockpiles, or other sources. Material shall be free from lumps and balls of clay and from organic and other objectionable matter. Not more than 25 percent by weight shall pass the 0.075 mm sieve. The portion of material passing the 0.425 mm sieve shall have a liquid limit less than 35 and a plasticity index less than 12. The maximum particle size shall not exceed 75 mm.

### PART 3 EXECUTION

#### 3.1 OPERATION OF AGGREGATE SOURCES

All clearing, stripping and excavating work involved in the opening or operation of aggregate sources shall be performed by the Contractor. Aggregate sources shall be opened to working depth in a manner that produces excavation faces that are as nearly vertical as practicable for the materials being excavated. Materials excavated from aggregate sources shall be obtained in successive cuts extending through all exposed strata. All pockets or strata of unsuitable materials overlying or occurring in the deposit shall be wasted as directed. The methods of operating aggregate sources and the processing and blending of the material may be changed or modified by the Contracting Officer, when necessary, in order to obtain material conforming to specified requirements. Upon completion of work, aggregate sources on Government reservations shall be conditioned to drain readily, and shall be left in a satisfactory condition. Aggregate sources on private lands shall be conditioned in agreement with local laws and authorities.

### 3.2 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer so as to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

### 3.3 PREPARATION OF UNDERLYING MATERIAL

Prior to constructing the subbase course, the underlying course or subgrade shall be cleaned of all foreign substances. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. Ruts, or soft yielding spots, in the underlying courses, subgrade areas having inadequate compaction, and deviations of the surface from the specified requirements, shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the subbase course is placed.

### 3.4 GRADE CONTROL

The finished and completed subbase course shall conform to the lines, grades, and cross sections shown. The lines, grades, and cross sections shown shall be maintained by means of line and grade stakes placed by the Contractor at the work site.

### 3.5 MIXING AND PLACING MATERIALS

The materials shall be mixed and placed to obtain uniformity of the subbase material at the water content specified. The Contractor shall make such adjustments in mixing or placing procedures or in equipment as may be directed to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to insure a satisfactory subbase course.

### 3.6 LAYER THICKNESS

The compacted thickness of the completed course shall be as indicated. When a compacted layer of 150 mm is specified, the material may be placed in a single layer; when a compacted thickness of more than 150 mm is required, no layer shall exceed 150 mm nor be less than 75 mm when compacted.

### 3.7 COMPACTION

Each layer of the subbase course shall be compacted as specified with approved compaction equipment. Water content shall be maintained during the compaction procedure to within plus or minus 2 percent of optimum water content, as determined from laboratory tests, as specified in paragraph SAMPLING AND TESTING. In all places not accessible to the rollers, the

mixture shall be compacted with hand-operated power tampers. Compaction shall continue until each layer is compacted through the full depth to at least 100 percent of laboratory maximum density. The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory subbase course. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

### 3.8 PROOF ROLLING

Areas designated on the drawings to be proof rolled shall receive an application of 30 coverages with a heavy pneumatic-tired roller having four or more tires abreast, each tire loaded to a minimum of 13.6 metric tons and inflated to a minimum of 1.035 MPa. A coverage is defined as the application of one tire print over the designated area. In the areas designated, proof rolling shall be applied to the top layer of the subbase course. Water content of the top layer of the subbase course shall be maintained such that the water content is within plus or minus 2 percent of optimum water content, as determined from laboratory tests, as specified in paragraph SAMPLING AND TESTING. Any material in the subbase courses or underlying materials indicated to be unsatisfactory by the proof rolling shall be removed, dried, and recompact, or removed and replaced with satisfactory materials.

### 3.9 EDGES

Approved material shall be placed along the edges of the subbase course in such quantity as will compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, at least a 300 mm width of the shoulder shall be rolled and compacted simultaneously with the rolling and compacting of each layer of the subbase course, as directed.

### 3.10 SMOOTHNESS TEST

The surface of each layer shall not show deviations in excess of 10 mm when tested with a 3.6 m (12 foot) straightedge applied parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding this amount shall be corrected by removing material, replacing with new material, or reworking existing material and compacting, as directed.

### 3.11 THICKNESS CONTROL

The completed thickness of the subbase course shall be in accordance with the thickness and grade indicated on the drawings. The thickness of each course shall be measured at intervals providing at least one measurement for each 400 square meters or part thereof of subbase course. The thickness measurement shall be made by test holes, at least 75 mm in diameter through the course. The completed subbase course shall not be more than 13 mm deficient in thickness nor more than 13 mm above or below the established grade. Where any of these tolerances are exceeded, the Contractor shall

correct such areas by scarifying, adding new material of proper gradation or removing material, and compacting, as directed. Where the measured thickness is 13 mm or more thicker than shown, the course will be considered as conforming with the specified thickness requirements plus 13 mm. The average job thickness shall be the average of the job measurements as specified above but within 6 mm of the thickness shown.

### 3.12 MAINTENANCE

The subbase course shall be maintained in a satisfactory condition until accepted.

-- End of Section --

## SECTION 02722

GRADED-CRUSHED AGGREGATE BASE COURSE  
05/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO T 180 (1997) Moisture-Density Relations of Soils  
Using a 4.54-kg (10-lb) Rammer and an 457 mm  
(18-in) Drop

AASHTO T 224 (1996) Correction for Coarse Particles in the  
Soil Compaction Test

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29/C 29M (1997) Bulk Density ("Unit Weight") and Voids  
in Aggregates

ASTM C 88 (1999a) Soundness of Aggregates by Use of  
Sodium Sulfate or Magnesium Sulfate

ASTM C 117 (1995) Materials Finer Than 75 micrometer  
(No. 200) Sieve in Mineral Aggregates by  
Washing

ASTM C 127 (1988; R 1993el) Specific Gravity and  
Absorption of Course Aggregate

ASTM C 128 (1997) Specific Gravity and Absorption of  
Fine Aggregate

ASTM C 131 (1996) Resistance to Degradation of  
Small-Size Coarse Aggregate by Abrasion and  
Impact in the Los Angeles Machine

ASTM C 136 (1996a) Sieve Analysis of Fine and Coarse  
Aggregates

ASTM D 75 (1987; R 1997) Sampling Aggregates

ASTM D 422 (1963; R 1998) Particle-Size Analysis of Soils



ASTM D 1556	(2000) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991; R 1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu.m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2487	(2000) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2922	(1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(2000) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM E 11	(1995) Wire-Cloth Sieves for Testing Purposes

## 1.2 DEFINITIONS

For the purposes of this specification, the following definitions apply.

### 1.2.1 Graded-crushed Aggregate Base Course

Graded-crushed aggregate (GCA) base course is well graded, crushed, durable aggregate uniformly moistened and mechanically stabilized by compaction. GCA is similar to ABC, but it has more stringent requirements and it produces a base course with higher strength and stability.

### 1.2.2 Degree of Compaction

Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 or AASHTO T 180, Method D and corrected with AASHTO T 224.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system

package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

SD-03 Product Data

Plant, Equipment, and Tools

List of proposed equipment to be used in performance of construction work, including descriptive data.

SD-06 Test Reports

Sampling and testing; GA-AO

Field Density Tests; GA-AO

Calibration curves and related test results prior to using the device or equipment being calibrated. Copies of field test results within 24 hours after the tests are performed. Certified copies of test results for approval not less than 30 days before material is required for the work.

1.4 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by a testing laboratory approved in accordance with Section 01451 CONTRACTOR QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. The materials shall be tested to establish compliance with the specified requirements; testing shall be performed at the specified frequency. The Contracting Officer may specify the time and location of the tests. Copies of test results shall be furnished to the Contracting Officer within 24 hours of completion of the tests.

1.4.1 Sampling

Samples for laboratory testing shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.4.2 Tests

The following tests shall be performed in conformance with the applicable standards listed.

1.4.2.1 Sieve Analysis

Sieve analysis shall be made in conformance with ASTM C 117 and ASTM C 136. Sieves shall conform to ASTM E 11. Particle-size analysis of the soils shall also be completed in conformance with ASTM D 422.

1.4.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

#### 1.4.2.3 Moisture-Density Determinations

The maximum density and optimum moisture content shall be determined in accordance with ASTM D 1557 if the material gradation contains less than 30 percent retained on the 19 mm sieve or AASHTO T180, Method D if the material gradation contains more than 30 percent on the 19 mm sieve. To maintain the same percentage of coarse material, the "remove and replace" procedure as described in the NOTE 8 in Paragraph 7.2 of AASHTO T 180 shall be used.

#### 1.4.2.4 Field Density Tests

Density shall be field measured in accordance with ASTM D 1556 ASTM D 2167 or ASTM D 2922. For the method presented in ASTM D 2922 the calibration curves shall be checked and adjusted if necessary using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D 2922 result in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration of ASTM D 2922, on each different type of material being tested at the beginning of a job and at intervals as directed.

#### 1.4.2.5 Wear Test

Wear tests shall be made on GCA course material in conformance with ASTM C 131.

#### 1.4.2.6 Soundness

Soundness tests shall be made on GCA in accordance with ASTM C 88.

#### 1.4.2.7 Weight of Slag

Weight per cubic meter of slag shall be determined in accordance with ASTM C 29/C 29M on the GCA course material.

#### 1.4.3 Testing Frequency

##### 1.4.3.1 Initial Tests

One of each of the following tests shall be performed on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements when furnished. If materials from more than one source are going to be utilized, this testing shall be completed for each source.

- a. Sieve Analysis including 0.02 mm size material.
- b. Liquid limit and plasticity index.

- c. Moisture-density relationship.
- d. Wear.
- e. Soundness.
- f. Weight per cubic meter of Slag.

#### 1.4.3.2 In Place Tests

Each of the following tests shall be performed on samples taken from the placed and compacted GCA]. Samples shall be taken and tested at the rates indicated.

a. Density tests shall be performed on every lift of material placed and at a frequency of one set of tests for every 250 square meters, or portion thereof, of completed area.

b. Sieve Analysis including 0.02 mm size material shall be performed for every 500 metric tons, or portion thereof, of material placed.

c. Liquid limit and plasticity index tests shall be performed at the same frequency as the sieve analysis.

#### 1.4.4 Approval of Material

The source of the material shall be selected 30 days prior to the time the material will be required in the work. Tentative approval of material will be based on initial test results. Final approval of the materials will be based on sieve analysis, liquid limit, and plasticity index tests performed on samples taken from the completed and fully compacted ABC and GCA.

#### 1.5 WEATHER LIMITATIONS

Construction shall be done when the atmospheric temperature is above 2 degrees C. When the temperature falls below 2 degrees C, the Contractor shall protect all completed areas by approved methods against detrimental effects of freezing. Completed areas damaged by freezing, rainfall, or other weather conditions shall be corrected to meet specified requirements.

#### 1.6 PLANT, EQUIPMENT, AND TOOLS

All plant, equipment, and tools used in the performance of the work will be subject to approval before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

### PART 2 PRODUCTS

#### 2.1 AGGREGATES

The GCA shall consist of clean, sound, durable particles of crushed stone,

crushed slag, crushed gravel, crushed recycled concrete, angular sand, or other approved material. GCA shall be free of silt and clay as defined by ASTM D 2487, organic matter, and other objectionable materials or coatings. The portion retained on the 4.75 mm sieve shall be known as coarse aggregate; that portion passing the 4.75 mm sieve shall be known as fine aggregate.

#### 2.1.1 Coarse Aggregate

Coarse aggregates shall be angular particles of uniform density. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements and shall be stockpiled separately.

a. Crushed Gravel: Crushed gravel shall be manufactured by crushing gravels, and shall meet all the requirements specified below.

b. Crushed Stone: Crushed stone shall consist of freshly mined quarry rock, and shall meet all the requirements specified below.

c. Crushed Recycled Concrete: Crushed recycled concrete shall consist of previously hardened portland cement concrete or other concrete containing pozzolanic binder material. The recycled material shall be free of all reinforcing steel, bituminous concrete surfacing, and any other foreign material and shall be crushed and processed to meet the required gradations for coarse aggregate. Crushed recycled concrete shall meet all other applicable requirements specified below.

d. Crushed Slag: Crushed slag shall be an air-cooled blast-furnace product having an air dry unit weight of not less than 1045 kg/cubic meter as determined by ASTM C 29/C 29M, and shall meet all the requirements specified below.

##### 2.1.1.1 Graded-Crushed Aggregate Base Course

GCA coarse aggregate shall not show more than 40 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C 131. GCA coarse aggregate shall not exhibit a loss greater than 40 percent weighted average, at five cycles, when tested for soundness in magnesium sulfate in accordance with ASTM C 88. The amount of flat and elongated particles shall not exceed 20 percent for the fraction retained on the 12.5 mm sieve nor 20 percent for the fraction passing the 12.5 mm sieve. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregate shall contain at least 90 percent by weight of crushed pieces having two or more freshly fractured faces with the area of each face being at least equal to 75 percent of the smallest midsectional area of the piece. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Crushed gravel shall be manufactured from gravel particles 90 percent of which by weight are retained on the maximum size sieve listed in TABLE 1.

#### 2.1.2 Fine Aggregate

Fine aggregates shall be angular particles of uniform density. When the fine aggregate is supplied from more than one source, aggregate from each source shall meet the specified requirements.

#### 2.1.2.1 Graded-Crushed Aggregate Base Course

GCA fine aggregate shall consist of angular particles produced by crushing stone, slag, recycled concrete, or gravel that meets the requirements for wear and soundness specified for GCA coarse aggregate.

#### 2.1.3 Gradation Requirements

The specified gradation requirements shall apply to the completed base course. The aggregates shall have a maximum size of [\_\_\_\_\_] mm and shall be continuously well graded within the limits specified in TABLE 1. Sieves shall conform to ASTM E 11.

TABLE 1. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	No. 1	No. 2	No. 3
-----	-----	-----	-----
50.0 mm	100	----	----
37.5 mm	70-100	100	----
25.0 mm	45-80	60-100	100
12.5 mm	30-60	30-65	40-70
4.75 mm	20-50	20-50	20-50
2.00 mm	15-40	15-40	15-40
0.425 mm	5-25	5-25	5-25
0.075 mm	0-8	0-8	0-8

NOTE 1: Particles having diameters less than 0.02 mm shall not be in excess of 3 percent by weight of the total sample tested.

NOTE 2: The values are based on aggregates of uniform specific gravity. If materials from different sources are used for the coarse and fine aggregates, they shall be tested in accordance with ASTM C 127 and ASTM C 128 to determine their specific gravities. If the specific gravities vary by more than 10 percent, the percentages passing the various sieves shall be corrected as directed by the Contracting Officer.

#### 2.1.4 Liquid Limit and Plasticity Index

Liquid limit and plasticity index requirements shall apply to the completed course and shall also apply to any component that is blended to meet the required gradation. The portion of any component or of the completed course passing the 0.425 mm sieve shall be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

## PART 3 EXECUTION

### 3.1 GENERAL REQUIREMENTS

When the GCA is constructed in more than one layer, the previously constructed layer shall be cleaned of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the working area. Line and grade stakes shall be provided as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

### 3.2 OPERATION OF AGGREGATE SOURCES

Aggregates shall be obtained from offsite sources.

### 3.3 STOCKPILING MATERIAL

Prior to stockpiling of material, storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled on the cleared and leveled areas designated by the Contracting Officer to prevent segregation. Materials obtained from different sources shall be stockpiled separately.

### 3.4 PREPARATION OF UNDERLYING COURSE

Prior to constructing the GCA, the underlying course or subgrade shall be cleaned of all foreign substances. At the time of construction of the GCA, the underlying course shall contain no frozen material. The surface of the underlying course or subgrade shall meet specified compaction and surface tolerances. The underlying course shall conform to Section 02721 SUBBASE COURSES. Ruts or soft yielding spots in the underlying courses, areas having inadequate compaction, and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade, and recompacting to specified density requirements. For cohesionless underlying courses containing sands or gravels, as defined in ASTM D 2487, the surface shall be stabilized prior to placement of the GCA. Stabilization shall be accomplished by mixing GCA into the underlying course and compacting by approved methods. The stabilized material shall be considered as part of the underlying course and shall meet all requirements of the underlying course. The finished underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the GCA is placed.

### 3.5 INSTALLATION

#### 3.5.1 Mixing the Materials

The coarse and fine aggregates shall be mixed in a stationary plant, or in a traveling plant or bucket loader on an approved paved working area. The

Contractor shall make adjustments in mixing procedures or in equipment as directed to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory GCA meeting all requirements of this specification.

#### 3.5.2 Placing

The mixed material shall be placed on the prepared subgrade or subbase in layers of uniform thickness with an approved spreader. When a compacted layer 150 mm or less in thickness is required, the material shall be placed in a single layer. When a compacted layer in excess of 150 mm is required, the material shall be placed in layers of equal thickness. No layer shall exceed 150 mm or less than 75mm when compacted. The layers shall be so placed that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the GCA is placed in more than one layer, the previously constructed layers shall be cleaned of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Such adjustments in placing procedures or equipment shall be made as may be directed to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to insure an acceptable GCA.

#### 3.5.3 Grade Control

The finished and completed GCA shall conform to the lines, grades, and cross sections shown. Underlying material(s) shall be excavated and prepared at sufficient depth for the required GCA thickness so that the finished GCA with the subsequent surface course will meet the designated grades.

#### 3.5.4 Compaction

Each layer of the GCA shall be compacted as specified with approved compaction equipment. Water content shall be maintained during the compaction procedure to within plus or minus 1 percent of the optimum water content determined from laboratory tests as specified in paragraph SAMPLING AND TESTING. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. In all places not accessible to the rollers, the mixture shall be compacted with hand-operated power tampers. Compaction shall continue until each layer has a degree of compaction that is at least 100 percent of laboratory maximum density through the full depth of the layer. The Contractor shall make such adjustments in compacting or finishing procedures as may be directed to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory GCA. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked, as directed, to meet the requirements of this specification.

#### 3.5.5 Thickness

Compacted thickness of the aggregate course shall be as indicated. No individual layer shall exceed 150 mm nor be less than 75 mm in compacted



thickness. The total compacted thickness of the GCA] course shall be within 13 mm of the thickness indicated. Where the measured thickness is more than 13 mm deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 13 mm thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 6 mm of the thickness indicated. The total thickness of the GCA] course shall be measured at intervals in such a manner as to ensure one measurement for each 500 square meters of base course. Measurements shall be made in 75 mm diameter test holes penetrating the base course.

#### 3.5.6 Finishing

The surface of the top layer of GCA shall be finished after final compaction by cutting any overbuild to grade and rolling with a steel-wheeled roller. Thin layers of material shall not be added to the top layer of base course to meet grade. If the elevation of the top layer of GCA is 13 mm or more below grade, then the top layer should be scarified to a depth of at least 75 mm and new material shall be blended in and compacted to bring to grade. Adjustments to rolling and finishing procedures shall be made as directed to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable base course. Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, the unsatisfactory portion shall be scarified, reworked and recompact or it shall be replaced as directed.

#### 3.5.7 Smoothness

The surface of the top layer shall show no deviations in excess of 10 mm when tested with a 3.05 meter straightedge. Measurements shall be taken in successive positions parallel to the centerline of the area to be paved. Measurements shall also be taken perpendicular to the centerline at 15 meter intervals. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

#### 3.6 TRAFFIC

Completed portions of the GCA course may be opened to limited traffic, provided there is no marring or distorting of the surface by the traffic. Heavy equipment shall not be permitted except when necessary to construction, and then the area shall be protected against marring or damage to the completed work.

#### 3.7 MAINTENANCE

The GCA shall be maintained in a satisfactory condition until the full pavement section is completed and accepted. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact. Any GCA that is not paved over prior to the onset of winter, shall be retested to verify that it still complies with the requirements of this specification. Any area of GCA that is damaged shall

be reworked or replaced as necessary to comply with this specification.

### 3.8 DISPOSAL OF UNSATISFACTORY MATERIALS

Any unsuitable materials that must be removed shall be disposed of as directed.  
No additional payments will be made for materials that must be replaced.

-- End of Section --

## SECTION 02731

AGGREGATE SURFACE COURSE  
01/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 117	(1995) Materials Finer Than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	(1987; R 1997) Sampling Aggregates
ASTM D 422	(1963; R 1998) Particle-Size Analysis of Soils
ASTM D 1556	(1990; R 1996el) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991; R 1998) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2922	(1996el) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 3017	(1988; R 1996el) Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth)
ASTM D 3740	(1999c) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction

ASTM D 4318 (1998) Liquid Limit, Plastic Limit, and Plasticity Index of Soils

ASTM E 11 (1995) Wire-Cloth Sieves for Testing Purposes

## 1.2 DEGREE OF COMPACTION

Degree of compaction is a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated herein as present laboratory maximum density.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

### SD-03 Product Data

#### Equipment

List of proposed equipment to be used in performance of construction work including descriptive data.

### SD-06 Test Reports

#### Sampling and Testing

##### Density Tests

Calibration curves and related test results prior to using the device or equipment being calibrated. Copies of field test results within 24 hours after the tests are performed. Test results from samples, not less than 30 days before material is required for the work. Results of laboratory tests for quality control purposes, for approval, prior to using the material.

## 1.4 EQUIPMENT

All plant, equipment, and tools used in the performance of the work covered by this section will be subject to approval by the Contracting Officer before the work is started and shall be maintained in satisfactory working condition at all times. The equipment shall be adequate and shall have the capability of producing the required compaction, and meeting the grade controls, thickness controls, and smoothness requirements set forth herein.

## 1.5 SAMPLING AND TESTING

Sampling and testing shall be the responsibility of the Contractor. Sampling and testing shall be performed by an approved commercial testing laboratory or by the Contractor, subject to approval. If the Contractor elects to establish its own testing facilities, approval of such facilities will be based on compliance with ASTM D 3740. No work requiring testing will be permitted until the Contractor's facilities have been inspected and approved.

### 1.5.1 Sampling

Sampling for material gradation, liquid limit, and plastic limit tests shall be taken in conformance with ASTM D 75. When deemed necessary, the sampling will be observed by the Contracting Officer.

### 1.5.2 Testing

#### 1.5.2.1 Gradation

Aggregate gradation shall be made in conformance with ASTM C 117, ASTM C 136, and ASTM D 422. Sieves shall conform to ASTM E 11.

#### 1.5.2.2 Liquid Limit and Plasticity Index

Liquid limit and plasticity index shall be determined in accordance with ASTM D 4318.

### 1.5.3 Approval of Materials

The source of the material to be used for producing aggregates shall be selected 30 days prior to the time the material will be required in the work. Approval of sources not already approved by the Corps of Engineers will be based on an inspection by the Contracting Officer. Tentative approval of materials will be based on appropriate test results on the aggregate source. Final approval of the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and compacted surface course.

## 1.6 WEATHER LIMITATIONS

Aggregate surface courses shall not be constructed when the ambient temperatures is below 2 degrees C and on subgrades that are frozen or contain frost. It shall be the responsibility of the Contractor to protect, by approved method or methods, all areas of surfacing that have not been accepted by the Contracting Officer. Surfaces damaged by freeze, rainfall, or other weather conditions shall be brought to a satisfactory condition by the Contractor.

## PART 2 PRODUCTS

### 2.1 AGGREGATES

Aggregates shall consist of clean, sound, durable particles of natural gravel, crushed gravel, crushed stone, sand, slag, soil, or other approved

materials processed and blended or naturally combined. Aggregates shall be free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign materials. The Contractor shall be responsible for obtaining materials that meet the specification and can be used to meet the grade and smoothness requirements specified herein after all compaction operations have been completed.

#### 2.1.1 Coarse Aggregates

The material retained on the 25 mm sieve shall be known as coarse aggregate.

Coarse aggregates shall be reasonably uniform in density and quality. The coarse aggregate shall have a percentage of wear not to exceed 50 percent after 500 revolutions as determined by ASTM C 131. The amount of flat and/or elongated particles shall not exceed 20 percent. A flat particle is one having a ratio of width to thickness greater than three; an elongated particle is one having a ratio of length to width greater than three. When the coarse aggregate is supplied from more than one source, aggregate from each source shall meet the requirements set forth herein.

#### 2.1.2 Fine Aggregates

The material passing the 25 mm sieve shall be known as fine aggregate. Fine aggregate shall consist of screenings, sand, soil, or other finely divided mineral matter that is processed or naturally combined with the coarse aggregate.

#### 2.1.3 Gradation Requirements

Gradation requirements specified in TABLE I shall apply to the completed aggregate surface. It shall be the responsibility of the Contractor to obtain materials that will meet the gradation requirements after mixing, placing, compacting, and other operations. TABLE I shows permissible gradings for granular material used in aggregate surface roads and airfields. Sieves shall conform to ASTM E 11.

TABLE I. GRADATION FOR AGGREGATE SURFACE COURSES

Sieve Designation	No. 1
50 mm	100
37.5 mm	70-100
25.0 mm	45-80
12.5 mm	30-60
4.75 mm	20-50
2 mm	15-40
.425 mm	5-25

#### 2.2 LIQUID LIMIT AND PLASTICITY INDEX REQUIREMENTS

The portion of the completed aggregate surface course passing the 0.425 mm sieve shall have a maximum liquid limit of 25 and a plasticity index of 4 to 9.

## PART 3 EXECUTION

### 3.1 OPERATION OF AGGREGATE SOURCES

Clearing, stripping, and excavating shall be the responsibility of the Contractor. The aggregate sources shall be operated to produce the quantity and quality of materials meeting these specification requirements in the specified time limit. Upon completion of the work, the aggregate sources on Government property shall be conditioned to drain readily and be left in a satisfactory condition. Aggregate sources on private lands shall be conditioned in agreement with local laws or authorities.

### 3.2 STOCKPILING MATERIALS

Prior to stockpiling the material, the storage sites shall be cleared and leveled by the Contractor. All materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at the locations designated. Aggregates shall be stockpiled in such a manner that will prevent segregation. Aggregates and binders obtained from different sources shall be stockpiled separately.

### 3.3 PREPARATION OF UNDERLYING COURSE SUBGRADE

The subgrade, including shoulders, shall be cleaned of all foreign substances. At the time of surface course construction, the subgrade shall contain no frozen material. Ruts or soft yielding spots in the subgrade areas having inadequate compaction and deviations of the surface from the requirements set forth herein shall be corrected by loosening and removing soft or unsatisfactory material and by adding approved material, reshaping to line and grade and recompacting to density requirements specified in Section 02721 SUBBASE COURSES. The completed subgrade shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition until the surface course is placed.

### 3.4 GRADE CONTROL

During construction, the lines and grades including crown and cross slope indicated for the aggregate surface course shall be maintained by means of line and grade stakes placed by the Contractor in accordance with the SPECIAL CONTRACT REQUIREMENTS.

### 3.5 MIXING AND PLACING MATERIALS

The materials shall be mixed and placed to obtain uniformity of the material and a uniform optimum water content for compaction. The Contractor shall make adjustments in mixing, placing procedures, or in equipment to obtain the true grades, to minimize segregation and degradation, to obtain the desired water content, and to ensure a satisfactory surface course.

### 3.6 LAYER THICKNESS

The aggregate material shall be placed on the subgrade in layers of uniform thickness. When a compacted layer of 150 mm or less is specified, the

material may be placed in a single layer; when a compacted thickness of more than 150 mm is required, no layer shall exceed 150 mm nor be less than 75 mm when compacted.

### 3.7 COMPACTION

Each layer of the aggregate surface course shall be compacted with approval compaction equipment. The water content during the compaction procedure shall be maintained at optimum or at the percentage specified by the Contracting Officer. In locations not accessible to the rollers, the mixture shall be compacted with mechanical tampers. Compaction shall continue until each layer through the full depth is compacted to at least 100 percent of laboratory maximum density. Any materials that are found to be unsatisfactory shall be removed and replaced with satisfactory material or reworked to produce a satisfactory material.

### 3.8 EDGES OF AGGREGATE-SURFACED ROAD

Approved material shall be placed along the edges of the aggregate surface course in such quantity as to compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, at least 300 mm of shoulder width shall be rolled and compacted simultaneously with the rolling and compacting of each layer of the surface course.

### 3.9 SMOOTHNESS TEST

The surface of each layer shall not show any deviations in excess of 10 mm when tested with a 3.66 m straightedge applied both parallel with and at right angles to the centerline of the area to be paved. Deviations exceeding this amount shall be corrected by the Contractor by removing material, replacing with new material, or reworking existing material and compacting, as directed.

### 3.10 THICKNESS CONTROL

The completed thickness of the aggregate surface course shall be within 12.5 mm, plus or minus, of the thickness indicated on plans. The thickness of the aggregate surface course shall be measured at intervals in such manner that there will be a thickness measurement for at least each 500 square meters of the aggregate surface course. The thickness measurement shall be made by test holes at least 75 mm in diameter through the aggregate surface course. When the measured thickness of the aggregate surface course is more than 13.5 mm deficient in thickness, the Contractor, at no additional expense to the Government, shall correct such areas by scarifying, adding mixture of proper gradation, reblading, and recompacting, as directed. Where the measured thickness of the aggregate surface course is more than 13.5 mm thicker than that indicated, it shall be considered as conforming with the specified thickness requirements plus 13.5 mm. The average job thickness shall be the average of the job measurements determined as specified above, but shall be within 6 mm of the thickness indicated. When the average job thickness fails to meet this criterion, the Contractor shall, at no additional expense to the Government, make corrections by scarifying, adding or removing mixture of proper gradation, and reblading and recompacting, as directed.



### 3.11 DENSITY TESTS

Density shall be measured in the field in accordance with ASTM D 1556 ASTM D 2167 ASTM D 2922. For the method presented in ASTM D 2922 the calibration curves shall be checked and adjusted, if necessary, using only the sand cone method as described in paragraph Calibration of the ASTM publication. Tests performed in accordance with ASTM D 2922 result in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gauges shall be made by the prepared containers of material method, as described in paragraph Calibration of ASTM D 2922, on each different type of material being tested at the beginning of a job and at intervals, as directed.

### 3.12 WEAR TEST

Wear tests shall be made in conformance with ASTM C 131.

### 3.13 MAINTENANCE

The aggregate surface course shall be maintained in a condition that will meet all specification requirements until accepted.

-- End of Section --

## SECTION 02741

## HOT-MIX ASPHALT (HMA) FOR ROADS

**09/99**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO MP 1	(1998) Provisional Specification for Performance Graded Asphalt Binder
AASHTO MP 2	(1998; Interim 1999) Superpave Volumetric Mix Design
AASHTO TP53	(1998; Interim 1999) Determining Asphalt Content of Hot Mix Asphalt by the Ignition Method

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29/C 29M	(1997) Bulk Density ("Unit Weight") and Voids in Aggregates
ASTM C 88	(1999a) Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 117	(1995) Materials Finer than 75 micrometer (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 566	(1997) Evaporable Total Moisture Content of Aggregate by Drying
ASTM C 1252	(1998) Uncompacted Void Content of Fine Aggregate (as Influenced by Particle Shape,

	Surface Texture, and Grading)
ASTM D 140	(1998) Sampling Bituminous Materials
ASTM D 242	(1995) Mineral Filler for Bituminous Paving Mixtures
ASTM D 946	(1999) Penetration-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 995	(1995b) Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures
ASTM D 1461	(1985)) Moisture or Volatile Distillates in Bituminous Paving Mixtures
ASTM D 1559	(1989) Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus
ASTM D 2041	(1995) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D 2172	(1995) Quantitative Extraction of Bitumen from Bituminous Paving Mixtures
ASTM D 2419	(1995) Sand Equivalent Value of Soils and Fine Aggregate
ASTM D 2489	(1984; R 1994el) Degree of Particle Coating of Bituminous-Aggregate Mixtures
ASTM D 2726	(1996el) Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixture
ASTM D 2950	(1997) Density of Bituminous Concrete in Place by Nuclear Method
ASTM D 3381	(1999) Viscosity-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 3665	(1999) Random Sampling of Construction Materials
ASTM D 3666	(1998) Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials
ASTM D 4125	(1994el) Asphalt Content of Bituminous Mixtures by the Nuclear Method
ASTM D 4791	(1999) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

ASTM D 4867/D 4867M	(1996) Effect of Moisture on Asphalt Concrete Paving Mixtures
ASTM D 5444	(1998) Mechanical Size Analysis of Extracted Aggregate
ASTM D 6307	(1998) Asphalt Content of Hot Mix Asphalt by Ignition Method

#### ASPHALT INSTITUTE (AI)

AI MS-2	(1997) Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types
AI MS-22	(1998; 2nd Edition) Construction of Hot-Mix Asphalt Pavements

#### CALIFORNIA DEPARTMENT OF TRANSPORTATION (CDT)

CDT Test 526	(1978) Operation of California Profilograph and Evaluation of Profiles
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#### CORPS OF ENGINEERS (COE)

COE CRD-C 171	(1995) Test Method for Determining Percentage of Crushed Particles in Aggregate
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### 1.2 DESCRIPTION OF WORK

The work shall consist of pavement courses composed of mineral aggregate and asphalt material heated and mixed in a central mixing plant and placed on a prepared course. HMA designed and constructed in accordance with this section shall conform to the lines, grades, thicknesses, and typical cross sections shown on the drawings. Each course shall be constructed to the depth, section, or elevation required by the drawings and shall be rolled, finished, and approved before the placement of the next course.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

SD-04 Samples

Asphalt Cement Binder; GA-AO

(20 L) sample for mix design verification.

Aggregates; GA-AO

Sufficient materials to produce 90 kg of blended mixture for mix design verification.

SD-06 Test Reports

Aggregates; GA-AO QC Monitoring; GA-AO

Aggregate and QC test results.

SD-07 Certificates

Asphalt Cement Binder; GA-AO

Copies of certified test data.

Testing Laboratory; G-AO

Certification of compliance.

Plant Scale Calibration Certification

Mix Design; GA-AO

Proposed JMF.

Contractor Quality Control; GA-AO

Quality control plan.

Material Acceptance and Percent Payment; GA-AO

Acceptance test results and pay calculations

1.4 METHOD OF MEASUREMENT

The amount paid for will be the number of metric tons of hot-mix asphalt mixture used in the accepted work. Hot-mix asphalt mixture shall be weighed after mixing, and no separate payment will be made for weight of asphalt cement material incorporated herein.

1.5 BASIS OF PAYMENT

Quantities of intermediate-and wearing-course mixtures, determined as specified above, will be paid for at respective contract unit prices or at reduced prices adjusted in accordance with paragraph MATERIAL ACCEPTANCE AND PERCENT PAYMENT. Payment shall constitute full compensation for furnishing all materials, equipment, plant, and tools; and for all labor and other incidentals necessary to complete work required by this section of the specification.

## 1.6 ASPHALT MIXING PLANT

Plants used for the preparation of hot-mix asphalt shall conform to the requirements of ASTM D 995 with the following changes:

a. Truck Scales. The asphalt mixture shall be weighed on approved certified scales at the Contractor's expense. Scales shall be inspected and sealed at least annually by an approved calibration laboratory.

b. Testing Facilities. The Contractor shall provide laboratory facilities at the plant for the use of the Government's acceptance testing and the Contractor's quality control testing.

c. Inspection of Plant. The Contracting Officer shall have access at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant; verifying weights, proportions, and material properties; checking the temperatures maintained in the preparation of the mixtures and for taking samples. The Contractor shall provide assistance as requested, for the Government to procure any desired samples.

d. Storage Bins. Use of storage bins for temporary storage of hot-mix asphalt will be permitted as follows:

(1) The asphalt mixture may be stored in non-insulated storage bins for a period of time not exceeding 3 hours.

(2) The asphalt mixture may be stored in insulated storage bins for a period of time not exceeding 8 hours. The mix drawn from bins shall meet the same requirements as mix loaded directly into trucks.

## 1.7 HAULING EQUIPMENT

Trucks used for hauling hot-mix asphalt shall have tight, clean, and smooth metal beds. To prevent the mixture from adhering to them, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material. Petroleum based products shall not be used as a release agent. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers (tarps) shall be securely fastened.

## 1.8 ASPHALT PAVERS

Asphalt pavers shall be self-propelled, with an activated screed, heated as necessary, and shall be capable of spreading and finishing courses of hot-mix asphalt which will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.

### 1.8.1 Receiving Hopper

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a

distribution system to place the mixture uniformly in front of the screed without segregation. The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

#### 1.8.2 Automatic Grade Controls

If an automatic grade control device is used, the paver shall be equipped with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated from either a reference line and/or through a system of mechanical sensors or sensor-directed mechanisms or devices which will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent. A transverse slope controller shall not be used to control grade. The controls shall be capable of working in conjunction with any of the following attachments:

- a. Ski-type device of not less than 9.14 m in length.
- b. Taut stringline set to grade.
- c. Short ski or shoe for joint matching.
- d. Laser control.

#### 1.9 ROLLERS

Rollers shall be in good condition and shall be operated at slow speeds to avoid displacement of the asphalt mixture. The number, type, and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. Equipment which causes excessive crushing of the aggregate shall not be used.

#### 1.10 WEATHER LIMITATIONS

The hot-mix asphalt shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 1. The temperature requirements may be waived by the Contracting Officer, if requested; however, all other requirements, including compaction, shall be met.

Table 1. Surface Temperature Limitations of Underlying Course

<u>Mat Thickness, mm</u>	<u>Degrees C</u>
75 or greater	4
Less than 75	7

#### PART 2 PRODUCTS

## 2.1 AGGREGATES

Aggregates shall consist of crushed stone, crushed gravel, crushed slag, screenings, natural sand and mineral filler, as required. The portion of material retained on the 4.75 mm sieve is coarse aggregate. The portion of material passing the 4.75 mm sieve and retained on the 0.075 mm sieve is fine aggregate. The portion passing the 0.075 mm sieve is defined as mineral filler. All aggregate test results and samples shall be submitted to the Contracting Officer at least 14 days prior to start of construction.

### 2.1.1 Coarse Aggregate

Coarse aggregate shall consist of sound, tough, durable particles, free from films of material that would prevent thorough coating and bonding with the asphalt material and free from organic matter and other deleterious substances. All individual coarse aggregate sources shall meet the following requirements:

a. The percentage of loss shall not be greater than 40 percent after 500 revolutions when tested in accordance with ASTM C 131.

b. The percentage of loss shall not be greater than 18 percent after five cycles when tested in accordance with ASTM C 88 using magnesium sulfate or 12 percent when using sodium sulfate.

c. At least 75 percent by weight of coarse aggregate shall have at least two or more fractured faces when tested in accordance with COE CRD-C 171. Fractured faces shall be produced by crushing.

d. The particle shape shall be essentially cubical and the aggregate shall not contain more than 20% percent, by weight, of flat and elongated particles (3:1 ratio of maximum to minimum) when tested in accordance with ASTM D 4791.

e. Slag shall be air-cooled, blast furnace slag, and shall have a compacted weight of not less than 1200 kg/cubic meter when tested in accordance with ASTM C 29/C 29M.

### 2.1.2 Fine Aggregate

Fine aggregate shall consist of clean, sound, tough, durable particles. The aggregate particles shall be free from coatings of clay, silt, or any objectionable material and shall contain no clay balls. All individual fine aggregate sources shall have a sand equivalent value not less than 45 when tested in accordance with ASTM D 2419.

The fine aggregate portion of the blended aggregate shall have an uncompacted void content not less than 43.0 percent when tested in accordance with ASTM C 1252 Method A.

### 2.1.3 Mineral Filler

Mineral filler shall be nonplastic material meeting the requirements of ASTM D 242.



#### 2.1.4 Aggregate Gradation

The combined aggregate gradation shall conform to gradations specified in Table 2, when tested in accordance with ASTM C 136 and ASTM C 117, and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa, but grade uniformly from coarse to fine.

Table 2. Aggregate Gradations

Sieve size	Intermediate Course (3/4" Max)	Surface Course (1/2" Max)
25.0	100	---
19.0	95-100	100
12.5	---	---
9.5	70-90	79-94
4.75	---	60-77
2.26	28-59	44-62
1.18	---	---
0.60	12-36	22-39
0.30	---	---
0.15	---	---
0.075	2-7	2-7

#### 2.2 ASPHALT CEMENT BINDER

Asphalt cement binder shall conform to ASTM D 3381 Table 2, Viscosity Grade AC-20. Test data indicating grade certification shall be provided by the supplier at the time of delivery of each load to the mix plant. Copies of these certifications shall be submitted to the Contracting Officer. The supplier is defined as the last source of any modification to the binder. The Contracting Officer may sample and test the binder at the mix plant at any time before or during mix production. Samples for this verification testing shall be obtained by the Contractor in accordance with ASTM D 140 and in the presence of the Contracting Officer. These samples shall be furnished to the Contracting Officer for the verification testing, which shall be at no cost to the Contractor. Samples of the asphalt cement specified shall be submitted for approval not less than 14 days before start of the test section.

#### 2.3 MIX DESIGN

The Contractor shall develop the mix design. The asphalt mix shall be composed of a mixture of well-graded aggregate, mineral filler if required, and asphalt material. The aggregate fractions shall be sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of the job mix formula (JMF). No hot-mix asphalt for payment shall be produced until a JMF has been approved.

The hot-mix asphalt shall be designed using procedures contained in AI MS-2 and the criteria shown in Table 3. If the Tensile Strength Ratio (TSR) of the composite mixture, as determined by ASTM D 4867/D 4867M is less than 75, the aggregates shall be rejected or the asphalt mixture treated with an

approved anti-stripping agent. The amount of anti-stripping agent added shall be sufficient to produce a TSR of not less than 75. If an antistrip agent is required, it shall be provided by the Contractor at no additional cost. Sufficient materials to produce 90 kg of blended mixture shall be provided to the Contracting Officer for verification of mix design at least 14 days prior to construction of test section.

At the option of the contractor a currently used DOT superpave hot mix may be used in lieu of developing a new hot mix design study as described herein. The superpave volumetric mix shall be designed in accordance with AASHTO MP 2.

#### 2.3.1 JMF Requirements

The job mix formula shall be submitted in writing by the Contractor for approval at least 14 days prior to the start of the test section and shall include as a minimum:

- a. Percent passing each sieve size.
- b. Percent of asphalt cement.
- c. Percent of each aggregate and mineral filler to be used.
- d. Asphalt viscosity grade, penetration grade, or performance grade.
- e. Number of blows of hammer per side of molded specimen.
- f. Laboratory mixing temperature.
- g. Lab compaction temperature.
- h. Temperature-viscosity relationship of the asphalt cement.
- i. Plot of the combined gradation on the 0.45 power gradation chart, stating the nominal maximum size.
- j. Graphical plots of stability, flow, air voids, voids in the mineral aggregate, and unit weight versus asphalt content as shown in AI MS-2.
- k. Specific gravity and absorption of each aggregate.
- l. Percent natural sand.
- m. Percent particles with 2 or more fractured faces (in coarse aggregate).
- n. Fine aggregate angularity.
- o. Percent flat or elongated particles (in coarse aggregate).
- p. Tensile Strength Ratio(TSR).
- q. Antistrip agent (if required) and amount.

r. List of all modifiers and amount.

s. Percentage and properties (asphalt content, binder properties, and aggregate properties) of reclaimed asphalt pavement (RAP) in accordance with paragraph RECYCLED HOT-MIX ASPHALT, if RAP is used.

Table 3. Marshall Design Criteria

<u>Test Property</u>	<u>75 Blow Mi</u>	<u>50 Blow Mix</u>
Stability, newtons minimum	*8000	*4450
Flow, 0.25 mm	8-16	8-18
Air voids, percent	3-5	3-5
Percent Voids in mineral aggregate (VMA)***, (minimum)		
Gradation 1	13.0	13.0
Gradation 2	14.0	14.0
Gradation 3	15.0	15.0
TSR, minimum percent	75	75

\* This is a minimum requirement. The average during construction shall be significantly higher than this number to ensure compliance with the specifications.

\*\* Calculate VMA in accordance with AI MS-2, based on ASTM D 2726 bulk specific gravity for the aggregate.

#### 2.3.2 Adjustments to Field JMF

The Laboratory JMF for each mixture shall be in effect until a new formula is approved in writing by the Contracting Officer. Should a change in sources of any materials be made, a new laboratory jmf design shall be performed and a new JMF approved before the new material is used. The Contractor will be allowed to adjust the Laboratory JMF within the limits specified below to optimize mix volumetric properties with the approval of the Contracting Officer. Adjustments to the Laboratory JMF shall be applied to the field (plant) established JMF and limited to those values as shown. Adjustments shall be targeted to produce or nearly produce 4 percent voids total mix (VTM).

TABLE 4. Field (Plant) Established JMF Tolerances  
Sieves                      Adjustments (plus or minus), percent

12.5 mm	3
4.75 mm	3
2.36 mm	3

TABLE 4. Field (Plant) Established JMF Tolerances	
Sieves	Adjustments (plus or minus), percent
0.075 mm	1
Binder Content	0.4

If adjustments are needed that exceed these limits, a new mix design shall be developed. Tolerances given above may permit the aggregate grading to be outside the limits shown in Table 2; while not desirable, this is acceptable.

## 2.4 RECYCLED HOT MIX ASPHALT

Recycled HMA shall consist of reclaimed asphalt pavement (RAP), coarse aggregate, fine aggregate, mineral filler, and asphalt cement. The RAP shall be of a consistent gradation and asphalt content and properties. When RAP is fed into the plant, the maximum RAP chunk size shall not exceed 50 mm.

The recycled HMA mix shall be designed using procedures contained in AI MS-2 and AI MS-22. The job mix shall meet the requirements of paragraph MIX DESIGN. The amount of RAP shall not exceed 30 percent.

### 2.4.1 RAP Aggregates and Asphalt Cement

The blend of aggregates used in the recycled mix shall meet the requirements of paragraph AGGREGATES. The percentage of asphalt in the RAP shall be established for the mixture design according to ASTM D 2172 using the appropriate dust correction procedure.

### 2.4.2 RAP Mix

The blend of new asphalt cement and the RAP asphalt binder shall meet the penetration viscosity dynamic shear rheometer at high temperature and bending beam at low temperature requirements in paragraph ASPHALT CEMENT BINDER. The virgin asphalt cement shall not be more than two standard asphalt material grades different than that specified in paragraph ASPHALT CEMENT BINDER.

## PART 3 EXECUTION

### 3.1 PREPARATION OF ASPHALT BINDER MATERIAL

The asphalt cement material shall be heated avoiding local overheating and providing a continuous supply of the asphalt material to the mixer at a uniform temperature. The temperature of unmodified asphalts shall be no more than 160 degrees C when added to the aggregates. Modified asphalts shall be no more than 174 degrees C when added to the aggregates.

### 3.2 PREPARATION OF MINERAL AGGREGATE

The aggregate for the mixture shall be heated and dried prior to mixing. No damage shall occur to the aggregates due to the maximum temperature and rate of heating used. The temperature of the aggregate and mineral filler shall not exceed 175 degrees C when the asphalt cement is added. The temperature shall not be lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of

satisfactory workability.

### 3.3 PREPARATION OF HOT-MIX ASPHALT MIXTURE

The aggregates and the asphalt cement shall be weighed or metered and introduced into the mixer in the amount specified by the JMF. The combined materials shall be mixed until the aggregate obtains a uniform coating of asphalt binder and is thoroughly distributed throughout the mixture. Wet mixing time shall be the shortest time that will produce a satisfactory mixture, but no less than 25 seconds for batch plants. The wet mixing time for all plants shall be established by the Contractor, based on the procedure for determining the percentage of coated particles described in ASTM D 2489, for each individual plant and for each type of aggregate used. The wet mixing time will be set to at least achieve 95 percent of coated particles. The moisture content of all hot-mix asphalt upon discharge from the plant shall not exceed 0.5 percent by total weight of mixture as measured by ASTM D 1461.

### 3.4 PREPARATION OF THE UNDERLYING SURFACE

Immediately before placing the hot mix asphalt, the underlying course shall be cleaned of dust and debris. A prime coat and/or tack coat shall be applied in accordance with the contract specifications.

### 3.5 TRANSPORTING AND PLACING

#### 3.5.1 Transporting

The hot-mix asphalt shall be transported from the mixing plant to the site in clean, tight vehicles. Deliveries shall be scheduled so that placing and compacting of mixture is uniform with minimum stopping and starting of the paver. Adequate artificial lighting shall be provided for night placements.

Hauling over freshly placed material will not be permitted until the material has been compacted as specified, and allowed to cool to 60 degrees C. To deliver mix to the paver, the Contractor shall use a material transfer vehicle which shall be operated to produce continuous forward motion of the paver.

#### 3.5.2 Placing

The mix shall be placed and compacted at a temperature suitable for obtaining density, surface smoothness, and other specified requirements. Upon arrival, the mixture shall be placed to the full width by an asphalt paver; it shall be struck off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and conform to the grade and contour indicated. The speed of the paver shall be regulated to eliminate pulling and tearing of the asphalt mat. Unless otherwise permitted, placement of the mixture shall begin along the centerline of a crowned section or on the high side of areas with a one-way slope. The mixture shall be placed in consecutive adjacent strips having a minimum width of 3 m. The longitudinal joint in one course shall offset the longitudinal joint in the course immediately below by at least 300 mm; however, the joint in the surface course shall be at the centerline of the pavement. Transverse joints in one course shall be offset by at least 3 m

from transverse joints in the previous course. Transverse joints in adjacent lanes shall be offset a minimum of 3 m. On isolated areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread and luted by hand tools.

### 3.6 COMPACTION OF MIXTURE

After placing, the mixture shall be thoroughly and uniformly compacted by rolling. The surface shall be compacted as soon as possible without causing displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor. The speed of the roller shall, at all times, be sufficiently slow to avoid displacement of the hot mixture and be effective in compaction. Any displacement occurring as a result of reversing the direction of the roller, or from any other cause, shall be corrected at once. Sufficient rollers shall be furnished to handle the output of the plant. Rolling shall continue until the surface is of uniform texture, true to grade and cross section, and the required field density is obtained. To prevent adhesion of the mixture to the roller, the wheels shall be kept properly moistened but excessive water will not be permitted. In areas not accessible to the roller, the mixture shall be thoroughly compacted with hand tampers. Any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or is in any way defective shall be removed full depth, replaced with fresh hot mixture and immediately compacted to conform to the surrounding area. This work shall be done at the Contractor's expense. Skin patching will not be allowed.

### 3.7 JOINTS

The formation of joints shall be made ensuring a continuous bond between the courses and to obtain the required density. All joints shall have the same texture as other sections of the course and meet the requirements for smoothness and grade.

#### 3.7.1 Transverse Joints

The roller shall not pass over the unprotected end of the freshly laid mixture, except when necessary to form a transverse joint. When necessary to form a transverse joint, it shall be made by means of placing a bulkhead or by tapering the course. The tapered edge shall be cut back to its full depth and width on a straight line to expose a vertical face prior to placing material at the joint. The cutback material shall be removed from the project. In both methods, all contact surfaces shall be given a light tack coat of asphalt material before placing any fresh mixture against the joint.

#### 3.7.2 Longitudinal Joints

Longitudinal joints which are irregular, damaged, uncompacted, cold (less than 80 degrees C at the time of placing adjacent lanes), or otherwise defective, shall be cut back a minimum of 50 mm from the edge with a cutting wheel to expose a clean, sound vertical surface for the full depth of the course. All cutback material shall be removed from the project. All

contact surfaces shall be given a light tack coat of asphalt material prior to placing any fresh mixture against the joint. The Contractor will be allowed to use an alternate method if it can be demonstrated that density, smoothness, and texture can be met.

### 3.8 CONTRACTOR QUALITY CONTROL

#### 3.8.1 General Quality Control Requirements

The Contractor shall develop an approved Quality Control Plan. Hot-mix asphalt for payment shall not be produced until the quality control plan has been approved. The plan shall address all elements which affect the quality of the pavement including, but not limited to:

- a. Mix Design
- b. Aggregate Grading
- c. Quality of Materials
- d. Stockpile Management
- e. Proportioning
- f. Mixing and Transportation
- g. Mixture Volumetrics
- h. Moisture Content of Mixtures
- i. Placing and Finishing
- j. Joints
- k. Compaction
- l. Surface Smoothness

#### 3.8.2 Testing Laboratory

The Contractor shall provide a fully equipped asphalt laboratory located at the plant or job site. The laboratory shall meet the requirements as required in ASTM D 3666. The effective working area of the laboratory shall be a minimum of 14 square meters with a ceiling height of not less than 2.3 m. Lighting shall be adequate to illuminate all working areas. It shall be equipped with heating and air conditioning units to maintain a temperature of 24 degrees C plus or minus 2.3 degrees C. Laboratory facilities shall be kept clean and all equipment shall be maintained in proper working condition. The Contracting Officer shall be permitted unrestricted access to inspect the Contractor's laboratory facility, to witness quality control activities, and to perform any check testing desired. The Contracting Officer will advise the Contractor in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are

serious enough to adversely affect test results, the incorporation of the materials into the work shall be suspended immediately and will not be permitted to resume until the deficiencies are corrected.

### 3.8.3 Quality Control Testing

The Contractor shall perform all quality control tests applicable to these specifications and as set forth in the Quality Control Program. The testing program shall include, but shall not be limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, moisture in the asphalt mixture, laboratory air voids, stability, flow, in-place density, grade and smoothness. A Quality Control Testing Plan shall be developed as part of the Quality Control Program.

#### 3.8.3.1 Asphalt Content

A minimum of two tests to determine asphalt content will be performed per lot (a lot is defined in paragraph MATERIAL ACCEPTANCE AND PERCENT PAYMENT) by one of the following methods: the extraction method in accordance with ASTM D 2172, Method A or B, the ignition method in accordance with the AASHTO TP53 or ASTM D 6307, or the nuclear method in accordance with ASTM D 4125, provided the nuclear gauge is calibrated for the specific mix being used. For the extraction method, the weight of ash, as described in ASTM D 2172, shall be determined as part of the first extraction test performed at the beginning of plant production; and as part of every tenth extraction test performed thereafter, for the duration of plant production. The last weight of ash value obtained shall be used in the calculation of the asphalt content for the mixture.

#### 3.8.3.2 Gradation

Aggregate gradations shall be determined a minimum of twice per lot from mechanical analysis of recovered aggregate in accordance with ASTM D 5444. When asphalt content is determined by the nuclear method, aggregate gradation shall be determined from hot bin samples on batch plants, or from the cold feed on drum mix plants. For batch plants, aggregates shall be tested in accordance with ASTM C 136 using actual batch weights to determine the combined aggregate gradation of the mixture.

#### 3.8.3.3 Temperatures

Temperatures shall be checked at least four times per lot, at necessary locations, to determine the temperature at the dryer, the asphalt cement in the storage tank, the asphalt mixture at the plant, and the asphalt mixture at the job site.

#### 3.8.3.4 Aggregate Moisture

The moisture content of aggregate used for production shall be determined a minimum of once per lot in accordance with ASTM C 566.

#### 3.8.3.5 Moisture Content of Mixture

The moisture content of the mixture shall be determined at least once per



lot in accordance with ASTM D 1461 or an approved alternate procedure.

#### 3.8.3.6 Laboratory Air Voids, Marshall Stability and Flow

Mixture samples shall be taken at least four times per lot and compacted into specimens, using 50 75 blows per side with the Marshall hammer as described in ASTM D 1559. After compaction, the laboratory air voids of each specimen shall be determined, as well as the Marshall stability and flow.

#### 3.8.3.7 In-Place Density

The Contractor shall conduct any necessary testing to ensure the specified density is achieved. A nuclear gauge may be used to monitor pavement density in accordance with ASTM D 2950.

#### 3.8.3.8 Grade and Smoothness

The Contractor shall conduct the necessary checks to ensure the grade and smoothness requirements are met in accordance with paragraph MATERIAL ACCEPTANCE AND PERCENT PAYMENT.

#### 3.8.3.9 Additional Testing

Any additional testing, which the Contractor deems necessary to control the process, may be performed at the Contractor's option.

#### 3.8.3.10 QC Monitoring

The Contractor shall submit all QC test results to the Contracting Officer on a daily basis as the tests are performed. The Contracting Officer reserves the right to monitor any of the Contractor's quality control testing and to perform duplicate testing as a check to the Contractor's quality control testing.

#### 3.8.4 Sampling

When directed by the Contracting Officer, the Contractor shall sample and test any material which appears inconsistent with similar material being produced, unless such material is voluntarily removed and replaced or deficiencies corrected by the Contractor. All sampling shall be in accordance with standard procedures specified.

#### 3.9 MATERIAL ACCEPTANCE LUMP SUM

Testing for acceptability of work will be performed by an independent laboratory hired by the Contractor. Test results and payment calculations shall be forwarded daily to the Contracting Officer. Acceptance of the plant produced mix and in-place requirements will be on a lot to lot basis. A standard lot for all requirements will be equal to 2000 metric tons. Where appropriate, adjustment in payment for individual lots of hot-mix asphalt will be made based on in-place density, laboratory air voids, grade and smoothness in accordance with the following paragraphs. Grade and surface smoothness determinations will be made on the lot as a whole.

Exceptions or adjustments to this will be made in situations where the mix within one lot is placed as part of both the intermediate and surface courses, thus grade and smoothness measurements for the entire lot cannot be made. In order to evaluate laboratory air voids and in-place (field) density, each lot will be divided into four equal sublots.

### 3.9.1 Sublot Sampling

One random mixture sample for determining laboratory air voids, theoretical maximum density, and for any additional testing the Contracting Officer desires, will be taken from a loaded truck delivering mixture to each sublot, or other appropriate location for each sublot. All samples will be selected randomly, using commonly recognized methods of assuring randomness conforming to ASTM D 3665 and employing tables of random numbers or computer programs. Laboratory air voids will be determined from three laboratory compacted specimens of each sublot sample in accordance with ASTM D 1559. The specimens will be compacted within 2 hours of the time the mixture was loaded into trucks at the asphalt plant. Samples will not be reheated prior to compaction and insulated containers will be used as necessary to maintain the temperature.

### 3.9.2 Additional Sampling and Testing

The Contracting Officer reserves the right to direct additional samples and tests for any area which appears to deviate from the specification requirements. The cost of any additional testing will be paid for by the Government. Testing in these areas will be in addition to the lot testing, and the requirements for these areas will be the same as those for a lot.

### 3.9.3 Laboratory Air Voids

Laboratory air voids will be calculated by determining the Marshall density of each lab compacted specimen using ASTM D 2726 and determining the theoretical maximum density of every other sublot sample using ASTM D 2041. Laboratory air void calculations for each sublot will use the latest theoretical maximum density values obtained, either for that sublot or the previous sublot. The mean absolute deviation of the four laboratory air void contents (one from each sublot) from the JMF air void content will be evaluated and a pay factor determined from Table 7. All laboratory air void tests will be completed and reported within 24 hours after completion of construction of each lot.

### 3.9.4 Mean Absolute Deviation

An example of the computation of mean absolute deviation for laboratory air voids is as follows: Assume that the laboratory air voids are determined from 4 random samples of a lot (where 3 specimens were compacted from each sample). The average laboratory air voids for each sublot sample are determined to be 3.5, 3.0, 4.0, and 3.7. Assume that the target air voids from the JMF is 4.0. The mean absolute deviation is then:

$$\text{Mean Absolute Deviation} = (|3.5 - 4.0| + |3.0 - 4.0| + |4.0 - 4.0| + |3.7 - 4.0|) / 4$$

$$= (0.5 + 1.0 + 0.0 + 0.3)/4 = (1.8)/4 = 0.45$$

The mean absolute deviation for laboratory air voids is determined to be 0.45. It can be seen from Table 7 that the lot's pay factor based on laboratory air voids, is 100 percent.

Table 7. Pay Factor Based on Laboratory Air Voids

Mean Absolute Deviation of Lab Air Voids from JMF	Pay Factor, %
0.60 or less	100
0.61 - 0.80	98
0.81 - 1.00	95
1.01 - 1.20	90
Above 1.20	reject (0)

### 3.9.5 In-place Density

#### 3.9.5.1 General Density Requirements

For determining in-place density, one random core will be taken by the Government from the mat (interior of the lane) of each subplot, and one random core will be taken from the joint (immediately over joint) of each subplot. Each random core will be full thickness of the layer being placed. When the random core is less than 25 mm thick, it will not be included in the analysis. In this case, another random core will be taken. After air drying to a constant weight, cores obtained from the mat and from the joints will be used for in-place density determination.

#### 3.9.5.2 Pay Factor Based on In-place Density

An example of the computation of a pay factor (in I-P units only) based on in-place density, is as follows: Assume the following test results for field density made on the lot: (1) Average mat density = 97.2 percent (of lab density). (2) Average joint density = 95.5 percent (of lab density). (3) Total area of lot = 30,000 square feet. (4) Length of completed longitudinal construction joint = 2000 feet.

a. Step 1: Determine pay factor based on mat density and on joint density, using Table 8:

Mat density of 97.2 percent = 98.3 pay factor.

Joint density of 95.5 percent = 97.3 pay factor.

b. Step 2: Determine ratio of joint area (length of longitudinal joint x 10 ft) to mat area (total paved area in the lot): Multiply the length of completed longitudinal construction joint by the specified 10 ft. width and divide by the mat area (total paved area in the lot).

$$(2000 \text{ ft.} \times 10 \text{ ft.})/30000 \text{ sq.ft.} = 0.6667 \text{ ratio of joint area to mat area (ratio).}$$

c. Step 3: Weighted pay factor (wpf) for joint is determined as indicated below:

$wpf = \text{joint pay factor} + (100 - \text{joint pay factor}) (1 - \text{ratio})$

$wpf = 97.3 + (100 - 97.3) (1 - .6667) = 98.2\%$

d. Step 4: Compare weighted pay factor for joint density to pay factor for mat density and select the smaller:

Pay factor for mat density: 98.3%. Weighted pay factor for joint density: 98.2%

Select the smaller of the two values as pay factor based on density: 98.2%

### 3.9.6 Grade

The final wearing surface of pavement shall conform to the elevations and cross sections shown and shall vary not more than 15 mm from the plan grade established and approved at site of work. Finished surfaces at juncture with other pavements shall coincide with finished surfaces of abutting pavements. Deviation from the plan elevation will not be permitted in areas of pavements where closer conformance with planned elevation is required for the proper functioning of drainage and other appurtenant structures involved. The final wearing surface of the pavement will be tested for conformance with specified plan grade requirements. The grade will be determined by running lines of levels at intervals of 7.6 m, or less, longitudinally and transversely, to determine the elevation of the completed pavement surface. Within 5 working days, after the completion of a particular lot incorporating the final wearing surface, the Contracting Officer will inform the Contractor in writing, of the results of the grade-conformance tests. When more than 5 percent of all measurements made within a lot are outside the 15 mm tolerance, the pay factor based on grade for that lot will be 95 percent. In areas where the grade exceeds the tolerance by more than 50 percent, the Contractor shall remove the surface lift full depth; the Contractor shall then replace the lift with hot-mix asphalt to meet specification requirements, at no additional cost to the Government. Diamond grinding may be used to remove high spots to meet grade requirements. Skin patching for correcting low areas or planing or milling for correcting high areas will not be permitted.

### 3.9.7 Surface Smoothness

The Contractor shall use one both of the following methods to test and evaluate surface smoothness of the pavement. All testing shall be performed in the presence of the Contracting Officer. Detailed notes of the results of the testing shall be kept and a copy furnished to the Government immediately after each day's testing. The profilograph method shall be used for all longitudinal and transverse testing, except where the runs would be less than 60 m in length and the ends where the straightedge shall be used. Where drawings show required deviations from a plane surface (crowns, drainage inlets, etc.), the surface shall be finished to meet the approval of the Contracting Officer.

#### 3.9.7.1 Smoothness Requirements

a. Straightedge Testing: The finished surfaces of the pavements shall have no abrupt change of 6 mm or more, and all pavements shall be within the tolerances specified in Table 9 when checked with an approved 4 m straightedge.

Table 9. Straightedge Surface Smoothness--Pavements

Pavement Category	Direction of Testing	Tolerance, mm
-----	-----	-----
All	Longitudinal	6
paved areas	Transverse	6

b. Profilograph Testing: The finished surfaces of the pavements shall have no abrupt change of 3 mm or more, and all pavement shall have a Profile Index not greater than specified in Table 10 when tested with an approved California-type profilograph. If the extent of the pavement in either direction is less than 60 m, that direction shall be tested by the straightedge method and shall meet requirements specified above.

Table 10. Profilograph Surface Smoothness--Pavements

Pavement Category	Direction of Testing	Maximum Specified Profile Index (mm/km)
-----	-----	-----
All Paved Areas	Longitudinal	140

### 3.9.7.2 Testing Method

After the final rolling, but not later than 24 hours after placement, the surface of the pavement in each entire lot shall be tested by the Contractor in such a manner as to reveal all surface irregularities exceeding the tolerances specified above. Separate testing of individual sublots is not required. If any pavement areas are ground, these areas shall be retested immediately after grinding. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines. The transverse lines shall be 8 m or less apart, as directed. The longitudinal lines shall be at the centerline of each paving lane for lines less than 6.1 m and at the third points for lanes 6.1 m or greater. Other areas having obvious deviations shall also be tested. Longitudinal testing lines shall be continuous across all joints.

a. Straightedge Testing. The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points.

b. Profilograph Testing. Profilograph testing shall be performed using approved equipment and procedures described in CDT Test 526. The equipment shall utilize electronic recording and automatic computerized

reduction of data to indicate "must-grind" bumps and the Profile Index for the pavement. The "blanking band" shall be 5 mm wide and the "bump template" shall span 25 mm with an offset of 10 mm. The profilograph shall be operated by an approved, factory-trained operator on the alignments specified above. A copy of the reduced tapes shall be furnished the Government at the end of each day's testing.

### 3.9.7.3 Payment Adjustment for Smoothness

a. Straightedge Testing. Location and deviation from straightedge for all measurements shall be recorded. When between 5.0 and 10.0 percent of all measurements made within a lot exceed the tolerance specified in paragraph Smoothness Requirements above, after any reduction of high spots or removal and replacement, the computed pay factor for that lot based on surface smoothness, will be 95 percent. When more than 10.0 percent of all measurements exceed the tolerance, the computed pay factor will be 90 percent. When between 15.0 and 20.0 percent of all measurements exceed the tolerance, the computed pay factor will be 75 percent. When 20.0 percent or more of the measurements exceed the tolerance, the lot shall be removed and replaced at no additional cost to the Government. Regardless of the above, any small individual area with surface deviation which exceeds the tolerance given above by more than 50 percent, shall be corrected by diamond grinding to meet the specification requirements above or shall be removed and replaced at no additional cost to the Government.

b. Profilograph Testing. Location and data from all profilograph measurements shall be recorded. When the Profile Index of a lot exceeds the tolerance specified in paragraph Smoothness Requirements above by 16 mm/km, but less than 32 mm/km, after any reduction of high spots or removal and replacement, the computed pay factor for that lot based on surface smoothness will be 95 percent. When the Profile Index exceeds the tolerance by 32 mm/km, but less than 47 mm/km, the computed pay factor will be 90 percent. When the Profile Index exceeds the tolerance by 47 mm/km, but less than 63 mm/km, the computed pay factor will be 75 percent. When the Profile Index exceeds the tolerance by 63 mm/km or more, the lot shall be removed and replaced at no additional cost to the Government. Regardless of the above, any small individual area with surface deviation which exceeds the tolerance given above by more than 79 mm/km or more, shall be corrected by grinding to meet the specification requirements above or shall be removed and replaced at no additional cost to the Government.

c. Bumps ("Must Grind" Areas). Any bumps ("must grind" areas) shown on the profilograph trace which exceed 10 mm in height shall be reduced by diamond grinding until they do not exceed 7.5 mm when retested. Such grinding shall be tapered in all directions to provide smooth transitions to areas not requiring grinding. The following will not be permitted: (1) skin patching for correcting low areas, (2) planing or milling for correcting high areas. At the Contractor's option, pavement areas, including ground areas, may be rechecked with the profilograph in order to record a lower Profile Index.

-- End of Section --

## SECTION 02748

BITUMINOUS TACK AND PRIME COATS  
01/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 20	(1970) Penetration Graded Asphalt Cement
AASHTO M 81	(1992) Cut-Back Asphalt (Rapid-Curing Type)
AASHTO M 82	(1975) Cut-Back Asphalt (Medium-Curing Type)
AASHTO M 226	(1980) Viscosity Graded Asphalt Cement
AASHTO T 40	(1978; R 1983) Sampling Bituminous Materials

## AMERICAN SOCIETY OF TESTING AND MATERIALS (ASTM)

ASTM D 140	(1993) Sampling Bituminous Materials
ASTM D 946	(1982; R 1993) Penetration-Graded Asphalt Cement for Use in Pavement Construction
ASTM D 977	(1991) Emulsified Asphalt
ASTM D 1250	(1980; R 1990) Petroleum Measurement Tables
ASTM D 2026	(1972; R 1993) Cutback Asphalt (Slow-Curing Type)
ASTM D 2027	(1976; R 1992) Cutback Asphalt (Medium-Curing Type)
ASTM D 2028	(1976; R 1992) Cutback Asphalt (Rapid-Curing Type)
ASTM D 2397	(1994) Cationic Emulsified Asphalt
ASTM D 2995	(1993) Determining Application Rate of Bituminous Distributors



ASTM D 3381

(1992) Viscosity-Graded Asphalt Cement for Use  
in Pavement Construction

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

### SD-06 Test Reports

#### Tests

Copies of all test results for bituminous materials, within 24 hours of completion of tests. Certified copies of the manufacturer's test reports indicating compliance with applicable specified requirements, not less than days before the material is required in the work.

## 1.3 PLANT, EQUIPMENT, MACHINES AND TOOLS

### 1.3.1 General Requirements

Plant, equipment, machines and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times.

### 1.3.2 Bituminous Distributor

The distributor shall have pneumatic tires of such size and number to prevent rutting, shoving or otherwise damaging the base surface or other layers in the pavement structure. The distributor shall be designed and equipped to spray the bituminous material in a uniform coverage at the specified temperature, at readily determined and controlled rates with an allowable variation from the specified rate of not more than plus or minus 5 percent, and at variable widths. Distributor equipment shall include a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. The distributor shall be equipped to circulate and agitate the bituminous material during the heating process.

### 1.3.3 Power Brooms and Power Blowers

Power brooms and power blowers shall be suitable for cleaning the surfaces

to which the bituminous coat is to be applied.

#### 1.4 WEATHER LIMITATIONS

Bituminous coat shall be applied only when the surface to receive the bituminous coat is dry. Bituminous coat shall be applied only when the atmospheric temperature in the shade is 10 degrees C or above and when the temperature has not been below 2 degrees C for the 12 hours prior to application.

### PART 2 PRODUCTS

#### 2.1 TACK COAT

Asphalt shall conform to ASTM D 3381 .

#### 2.2 PRIME COAT

### PART 3 EXECUTION

#### 3.1 PREPARATION OF SURFACE

Immediately before applying the bituminous coat, all loose material, dirt, clay, or other objectionable material shall be removed from the surface to be treated. The surface shall be dry and clean at the time of treatment.

#### 3.2 APPLICATION RATE

The exact quantities within the range specified, which may be varied to suit field conditions, will be determined by the Contracting Officer.

##### 3.2.1 Tack Coat

Bituminous material for the tack coat shall be applied in quantities of not less than 0.20 liter nor more than 0.70 liter per square meter of pavement surface.

##### 3.2.2 Prime Coat

Bituminous material for the prime coat shall be applied in quantities of not less than 0.70 liter nor more than 1.80 liters per square meter of pavement surface.

#### 3.3 APPLICATION TEMPERATURE

##### 3.3.1 Viscosity Relationship

Asphalt application temperature shall provide an application viscosity between 10 and 60 seconds, Saybolt Furol, or between 20 and 120 square mm/sec, kinematic. The temperature viscosity relation shall be furnished to the Contracting Officer.

##### 3.3.2 Temperature Ranges

The viscosity requirements shall determine the application temperature to be used. The following is a normal range of application temperatures:

#### Liquid Asphalts

[MC-30	29-87 degrees C]
[MC-70	50-107 degrees C]
[RC-70	50-90 degrees C*]
[RC-250	75-12 degrees C*]

#### Paving Grade Asphalts

#### Viscosity Grades

[SS-1	20-70 degrees C]
[SS-1h	20-70 degrees C]
[CSS-1	20-70 degrees C]
[CSS-1h	20-70 degrees C]

\*These temperature ranges exceed the flash point of the material and care should be taken in their heating.

### 3.4 APPLICATION

Following preparation and subsequent inspection of the surface, the bituminous coat shall be applied at the specified rate with uniform distribution over the surface to be treated. All areas and spots missed by the distributor shall be properly treated with the hand spray. Until the succeeding layer of pavement is placed, the surface shall be maintained by protecting the surface against damage and by repairing deficient areas at no additional cost to the Government. If required, clean dry sand shall be spread to effectively blot up any excess bituminous material. No smoking, fires, or flames other than those from the heaters that are a part of the equipment shall be permitted within 8 meters of heating, distributing, and transferring operations of bituminous material other than bituminous emulsions. To obtain uniform application of the prime coat on the surface treated at the junction of previous and subsequent applications, building paper shall be spread on the surface for a sufficient distance back from the ends of each application to start and stop the prime coat on the paper. Immediately after application, the building paper shall be removed and destroyed.

### 3.5 CURING PERIOD

Following application of the bituminous material and prior to application of the succeeding layer of pavement, the bituminous coat shall be allowed to cure and to obtain evaporation of any volatiles or moisture. Prime coat shall be allowed to cure without being disturbed for a period of at least 48 hours or longer, as may be necessary to attain penetration into the treated

course.

### 3.6 FIELD QUALITY CONTROL

Samples of the bituminous material used shall be obtained by the Contractor as directed, under the supervision of the Contracting Officer. The sample may be retained and tested by the Government at no cost to the Contractor.

### 3.7 SAMPLING AND TESTING

Sampling and testing shall be performed by an approved commercial testing laboratory or by facilities furnished by the Contractor. No work requiring testing will be permitted until the facilities have been inspected and approved.

#### 3.7.1 Sampling

The samples of bituminous material, unless otherwise specified, shall be in accordance with ASTM D 140 or AASHTO T 40. Sources from which bituminous materials are to be obtained shall be selected and notification furnished the Contracting Officer within 15 days after the award of the contract.

#### 3.7.2 Calibration Test

The Contractor shall furnish all equipment, materials, and labor necessary to calibrate the bituminous distributor. Calibration shall be made with the approved job material and prior to applying the bituminous coat material to the prepared surface. Calibration of the bituminous distributor shall be in accordance with ASTM D 2995.

#### 3.7.3 Trial Applications

Before providing the complete bituminous coat, three lengths of at least 30 meters for the full width of the distributor bar shall be applied to evaluate the amount of bituminous material that can be satisfactorily applied.

##### 3.7.3.1 Tack Coat Trial Application Rate

Unless otherwise authorized, the trial application rate of bituminous tack coat materials shall be applied in the amount of 0.20 liters per square meter. Other trial applications shall be made using various amounts of material as may be deemed necessary.

##### 3.7.3.2 Prime Coat Trial Application Rate

Unless otherwise authorized, the trial application rate of bituminous materials shall be applied in the amount of 1.10 liters per square meter. Other trial applications shall be made using various amounts of material as may be deemed necessary.

#### 3.7.4 Sampling and Testing During Construction

Quality control sampling and testing shall be performed as required in

paragraph FIELD QUALITY CONTROL.

-- End of Section --

## SECTION 02754A

CONCRETE PAVEMENTS FOR SMALL PROJECTS  
03/97

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ACI INTERNATIONAL (ACI)

- |           |   |
|-----------|---|
| ACI 211.1 | (1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete |
| ACI 301   | (1996) Standard Specification for Structural Concrete   |
| ACI 305R  | (1991) Hot Weather Concreting   |

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- |                   |   |
|-------------------|---|
| ASTM A 184/A 184M | (1996) Fabricated Deformed Steel Bar Mats for Concrete Reinforcement    |
| ASTM A 615/A 615M | (1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement |
| ASTM C 31/C 31M   | (1996) Making and Curing Concrete Test Specimens in the Field           |
| ASTM C 33         | (1997) Concrete Aggregates  |
| ASTM C 39         | (1996) Compressive Strength of Cylindrical Concrete Specimens           |
| ASTM C 94         | (1997) Ready-Mixed Concrete   |
| ASTM C 123        | (1996) Lightweight Pieces in Aggregate                                  |
| ASTM C 143        | (1990a) Slump of Hydraulic Cement Concrete                              |
| ASTM C 150        | (1997) Portland Cement  |
| ASTM C 192/C 192M | (1995) Making and Curing Concrete Test Specimens in the Laboratory      |

ASTM C 231	(1997) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(1995) Air-Entraining Admixtures for Concrete
ASTM C 494	(1992) Chemical Admixtures for Concrete
ASTM C 595	(1998) Blended Hydraulic Cements
ASTM C 618	(1997) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 666	(1992) Resistance of Concrete to Rapid Freezing and Thawing
ASTM C 881	(1990) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 989	(1997) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM C 1077	(1997) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM D 1751	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

## ARMY CORPS OF ENGINEERS (COE)

COE CRD-C 130	(1989) Scratch Hardness of Coarse Aggregate Particles
COE CRD-C 300	(1990) Specifications for Membrane-Forming Compounds for Curing Concrete
COE CRD-C 540	(1971; R 1981) Standard Specification for Nonbituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavements, Sawable Type
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop

## NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100	(1996) Concrete Plant Standards
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## 1.2 SYSTEM DESCRIPTION

This section is intended to stand alone for construction of concrete (rigid) pavement. However, where the construction covered herein interfaces with other sections, the construction at each interface shall conform to the requirements of both this section and the other section, including tolerances for both.

## 1.3 ACCEPTABILITY OF WORK

The pavement will be accepted on the basis of tests made by the Government and by the Contractor or its suppliers, as specified herein. The Government may, at its discretion, make check tests to validate the results of the Contractor's testing. Concrete samples shall be taken by the Contractor at the placement to determine the slump, air content, and strength of the concrete. Test cylinders shall be made for determining conformance with the strength requirements of these specifications and, when required, for determining the time at which pavements may be placed into service. All air content measurements shall be determined in accordance with ASTM C 231. All slump tests shall be made in accordance with ASTM C 143. All test cylinders shall be 150 by 300 mm cylinders and shall be fabricated in accordance with ASTM C 192/C 192M, using only steel molds, cured in accordance with ASTM C 31/C 31M, and tested in accordance with ASTM C 39. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. The Contractor shall furnish all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the site and in the laboratory.

### 1.3.1 Evaluation Sampling

Sampling, testing, and mixture proportioning shall be performed by a commercial Testing Laboratory, conforming with ASTM C 1077. The individuals who sample and test concrete and concrete constituents shall be certified as American Concrete Institute (ACI) Concrete Field Testing Technicians, Grade I. The individuals who perform the inspection of concrete shall be certified as ACI Concrete Construction Inspector, Level II. All mix design, weekly quality control reports, smoothness reports, and project certification reports shall be signed by a Registered Engineer.

### 1.3.2 Surface Testing

Surface testing for surface smoothness and plan grade shall be performed as indicated below by the Testing Laboratory. The measurements shall be properly referenced in accordance with paving lane identification and stationing, and a report given to the Government within 24 hours after measurement is made. A final report of surface testing, signed by a Registered Engineer, containing all surface measurements and a description of all actions taken to correct deficiencies, shall be provided to the Government upon conclusion of surface testing.

#### 1.3.2.1 Surface Smoothness Requirements

The finished surfaces of the pavements shall have no abrupt change of 3 mm



or more, and all pavements shall be within the tolerances specified in Table 1 when checked with the straightedge.

TABLE 1  
STRAIGHTEDGE SURFACE SMOOTHNESS--PAVEMENTS

Tank Hardstands, Parking	Longitudinal	6.5
Areas, Open Storage Areas	Transverse	6.5

#### 1.3.2.2 Surface Smoothness Testing Method

The surface of the pavement shall be tested with the straightedge to identify all surface irregularities exceeding the tolerances specified above. The entire area of the pavement shall be tested in both a longitudinal and a transverse direction on parallel lines approximately 4.5 m apart. The straightedge shall be held in contact with the surface and moved ahead one-half the length of the straightedge for each successive measurement. The amount of surface irregularity shall be determined by placing the straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length and measuring the maximum gap between the straightedge and the pavement surface, in the area between these two high points.

#### 1.3.3 Plan Grade Testing and Conformance

The finished surface of the pavements shall conform, within the tolerances shown in Table 1, to the lines, grades, and cross sections shown. The finished surface of new abutting pavements shall coincide at their juncture. The finished surface of airfield runway, taxiway, and apron pavements shall vary not more than 12 mm above or below the plan grade line or elevation indicated. The surfaces of other pavements shall vary not more than 18 mm above or below the plan grade line or elevation indicated. Each pavement category shall be checked by the Contractor for conformance with plan grade requirements by running lines of levels at intervals to determine the elevation at each joint intersection.

#### 1.4 PRECONSTRUCTION TESTING OF MATERIALS

The Contractor shall not be entitled to any additional payment or extension of time because of delays caused by sampling and testing additional sources, or samples, necessitated by failure of any samples. Aggregates shall be sampled and tested by the Test Laboratory and shall be representative of the materials to be used for the project. Test results, signed by a Registered Engineer, shall be submitted 45 days before commencing paving. No aggregate shall be used unless test results show that it meets all requirements of these specifications, including compliance with ASTM C 33 and deleterious materials limitations.

#### 1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be

submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment;

Manufacturer's literature on the concrete plant; mixing equipment; hauling equipment; placing and finishing, and curing equipment; at least 7 days prior to start of paving.

Paving; G, RE

Paving Schedules at least 7 days prior to start of paving.

Mixture Proportions; G, KC

The report of the Contractor's mixture proportioning studies showing the proportions of all ingredients and supporting information on aggregate and other materials that will be used in the manufacture of concrete, at least 14 days prior to commencing concrete placing operations.

1.6 EQUIPMENT

1.6.1 Batching and Mixing

The batching plant shall conform to NRMCA CPMB 100, the equipment requirements in ASTM C 94, and as specified. Water shall not be weighed or measured cumulatively with another ingredient. All concrete materials batching shall meet ASTM C 94 requirements. Mixers shall be [stationary mixers] [truck mixers]. Batching, mixers, mixing time, permitted reduction of mixing time, and concrete uniformity shall meet the requirements of ASTM C 94, and shall be documented in the initial weekly QC Report.

1.6.2 Transporting Equipment

Transporting equipment shall be in conformance with ASTM C 94 and as specified herein. Concrete shall be transported to the paving site in rear-dump trucks, in truck mixers designed with extra large blading and rear opening specifically for low slump concrete, or in agitators. Bottom-dump trucks shall not be used for delivery of concrete.

1.6.3 Delivery Equipment

When concrete transport equipment cannot operate on the paving lane, side-delivery transport equipment consisting of self-propelled moving conveyors shall be used to deliver concrete from the transport equipment and discharge it in front of the paver. Front-end loaders, dozers, or similar equipment shall not be used to distribute the concrete.

1.6.4 Paver-Finisher

The paver-finisher shall be a heavy-duty, self-propelled machine designed specifically for paving and finishing high quality pavement. The

paver-finisher shall spread, consolidate, and shape the plastic concrete to the desired cross section in one pass. The paver-finisher shall be equipped with a full width "knock-down" auger, capable of operating in both directions, which will evenly spread the fresh concrete in front of the screed or extrusion plate. Immersion vibrators shall be gang mounted at the front of the paver on a frame equipped with suitable controls so that all vibrators can be operated at any desired depth within the slab or completely withdrawn from the concrete. The vibrators shall be automatically controlled so that they will be immediately stopped as forward motion of the paver ceases. The spacing of the immersion vibrators across the paving lane shall be as necessary to properly consolidate the concrete, but the clear distance between vibrators shall not exceed 750 mm, and the outside vibrators shall not exceed 300 mm from the edge of the lane. The paver-finisher shall be equipped with a transversely oscillating screed or an extrusion plate to shape, compact, and smooth the surface.

#### 1.6.4.1 Paver-Finisher with Fixed Forms

The paver-finisher shall be equipped with wheels designed to ride the forms, keep it aligned with the forms, and to spread the preventing deformation of the forms.

#### 1.6.5 Curing Equipment

Equipment for curing is specified in paragraph CURING.

#### 1.6.6 Texturing Equipment

Texturing equipment shall be as specified below.

##### 1.6.6.1 Fabric Drag

A fabric drag shall consist of a piece of fabric material as wide as the lane width securely attached to a separate wheel mounted frame spanning the paving lane or to one of the other similar pieces of equipment. The material shall be wide enough to provide 300 to 450 mm dragging flat on the pavement surface. [The fabric material shall be clean, reasonably new burlap, kept clean and saturated during use.

#### 1.6.7 Sawing Equipment

Equipment for sawing joints and for other similar sawing of concrete shall be standard diamond-tip-bladed concrete saws mounted on a wheeled chassis.

#### 1.6.8 Straightedge

The Contractor shall furnish and maintain at the job site one 4 m straightedge for testing concrete surface smoothness. The straightedge shall be constructed of aluminum or magnesium alloy and shall have blades of box or box-girder cross section with flat bottom, adequately reinforced to insure rigidity and accuracy. Straightedges shall have handles for operation on the pavement.

## PART 2 PRODUCTS

## 2.1 CEMENTITIOUS MATERIALS

Cementitious materials shall be [portland cement [and pozzolan]] and shall conform to appropriate specifications listed below.

### 2.1.1 Portland Cement

Portland cement shall conform to ASTM C 150 [Type II, low-alkali].

### 2.1.2 High-Early-Strength Portland Cement

High-early-strength cement shall conform to ASTM C 150 Type III, with C3A limited to [5] percent, [low-alkali].

### 2.1.3 Pozzolan (Fly Ash)

Fly ash shall conform to ASTM C 618 Class F, including all the supplementary optional physical requirements.

## 2.2 AGGREGATES

Aggregates shall consist of clean, hard, uncoated particles meeting the requirements of ASTM C 33, including deleterious materials, abrasion loss and soundness requirements of ASTM C 33 Class 5S, and other requirements specified herein.

### 2.2.1 Coarse Aggregate

Coarse aggregate shall consist of [crushed] gravel, crushed stone, or a combination thereof. The nominal maximum size of the coarse aggregate shall be 25.0 mm. When the nominal maximum size is greater than 25.0 mm, the aggregates shall be furnished in two ASTM C 33 size groups, No. 67 and No. 4. The amount of deleterious material in each size of coarse aggregate shall not exceed the limits shown in ASTM C 33 Class 5S, depending on the weathering region, and the following limits:

- a. Lightweight particles 1.0 max. percent by mass (ASTM C 123).
- b. Other soft particles 3.0 max. percent by mass (COE CRD-C 130).
- c. Total of all deleterious 5.0 max. percent by mass (substances listed in ASTM C 33 and above, exclusive of material finer than 0.075 mm sieve).
- d. The separation medium for lightweight particles shall have a density of 2.0 Mg/cubic meters.

### 2.2.2 Fine Aggregate

Fine aggregate shall consist of natural sand, manufactured sand, or a combination of the two, and shall be composed of clean, hard, durable particles. All fine aggregate shall be composed of clean, hard, durable particles meeting the requirements of ASTM C 33 and the requirements herein.

The amount of deleterious material in the fine aggregate shall not exceed the limits in ASTM C 33 and shall not exceed the following limits:

- a. Lightweight particles (ASTM C 123) 1.0 percent max. by mass using a medium with a density of 2.0 Mg/cubic meter.
- b. The total of all deleterious material types, listed in ASTM C 33 and above, shall not exceed 3.0 percent of the mass of the fine aggregate.

## 2.3 CHEMICAL ADMIXTURES

Air-entraining admixture shall conform to ASTM C 260. An accelerator shall be used only when specified in paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES and shall not be used to reduce the amount of cementitious material used. Accelerator shall conform to ASTM C 494 Type C. Calcium chloride and admixtures containing calcium chloride shall not be used. A water-reducing or retarding admixture shall meet the requirements of ASTM C 494. Type G or H admixtures are not allowed.

## 2.4 CURING MATERIALS

Membrane forming curing compound shall be a white pigmented compound conforming to COE CRD-C 300. Burlap shall be new or shall be clean material never used for anything other than curing concrete.

## 2.5 WATER

Water for mixing and curing shall be clean, potable, and free of injurious amounts of oil, acid, salt, or alkali.

## 2.6 JOINT MATERIALS

### 2.6.1 Expansion Joint Material

Expansion joint filler shall be a preformed material conforming to [ASTM D 1751. Expansion joint filler shall be 20 mm thick.

### 2.6.2 Slip Joint Material

Slip joint material shall be 6 mm thick expansion joint filler conforming to ASTM D 1751.

## 2.7 REINFORCING

### 2.7.1 General

Reinforcing bars shall conform to ASTM A 615/A 615M Grade 60. Bar mats shall conform to ASTM A 184/A 184M. Reinforcement shall be free from loose, flaky rust, loose scale, oil, grease, mud, or other coatings that might reduce the bond with concrete.

## 2.8 DOWELS AND TIE BARS

### 2.8.1 Dowels

Dowels shall be single piece, plain (non-deformed) steel bars conforming to ASTM A 615/A 615M Grade 60 or higher. Dowels shall be free of loose, flaky rust and loose scale and shall be clean and straight.

### 2.8.2 Tie Bars

Tie bars shall be deformed steel bars conforming to ASTM A 615/A 615M Grade 60. Grade 60 or higher shall not be used for bars that are bent and straightened during construction.

## 2.9 EPOXY RESIN

All epoxy-resin materials shall be two-component materials conforming to ASTM C 881, Class as appropriate for each application temperature to be encountered; except, that in addition, the materials shall meet the following requirements:

- a. Material for use for embedding dowels and anchor bolts shall be Type IV, Grade 3.
- b. Material for use as patching for complete filling of spalls, wide cracks, and other voids and for use in preparing epoxy resin mortar shall be Type III, Grade as approved.
- c. Material for injecting cracks shall be Type IV, Grade 1.
- d. Material for bonding freshly mixed portland cement concrete, mortar, or freshly mixed epoxy resin concrete to hardened concrete shall be Type V, Grade as approved.

## 2.10 SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES

Specified compressive strength,  $f'_c$ , for concrete is 34.5 MPa at 28 days. Maximum allowable water-cementitious material ratio is [0.45]. The water-cementitious material ratio is based on absolute volume equivalency, where the ratio is determined using the weight of cement for a cement only mix, or using the total volume of cement plus pozzolan converted to an equivalent weight of cement by the absolute volume equivalency method described in ACI 211.1. The concrete shall be air-entrained with a total air content of [6] plus or minus 1 percent. The maximum allowable slump of the concrete shall be 75 mm for pavement constructed with fixed forms. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength  $f'_c$  and no individual test result falls below the specified strength  $f'_c$  by more than 3.5 MPa. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.

## 2.11 MIXTURE PROPORTIONS

### 2.11.1 Composition Concrete

Composition concrete shall be composed of cementitious material, water, fine and coarse aggregates, and admixtures. Fly ash, if used, shall be used only at a rate of 30 percent by mass of the total cementitious material. Admixtures shall consist of air entraining admixture and [shall also include retarder] [water-reducing admixture]. High range water-reducing admixtures and admixtures to produce flowable concrete shall not be used. No substitutions shall be made in the materials used in the mixture proportions without additional tests to show that the quality of the concrete is satisfactory.

#### 2.11.2 Concrete Mixture Proportioning Studies

Trial design batches, mixture proportioning studies, and testing shall be the responsibility of the Contractor, and shall be performed by the Test Laboratory and signed by a Registered Engineer. No concrete pavement shall be placed until the Contracting Officer has approved the Contractor's mixture proportions. All materials used in mixture proportioning studies shall be representative of those proposed for use on the project. If there is a change in materials, additional mixture design studies shall be made using the new materials. Trial mixtures having proportions, slumps, and air content suitable for the work shall be based on methodology described in ACI 211.1. At least three different water-cementitious ratios, which will produce a range of strength encompassing that required on the project, shall be used. Laboratory trial mixtures shall be proportioned for maximum permitted slump and air content. Maximum sand content shall be 40 percent of the total aggregate SSD weight. Aggregate quantities shall be based on the mass in a saturated surface dry condition.

#### 2.11.3 Mixture Proportioning Procedure

The Contractor shall perform the following:

- a. Fabricate, cure and test 6 test cylinders per age for each mixture at 7 and 28 days.
- b. Using the average strength for each  $w/(c+p)$ , plot the results from each of the three mixtures on separate graphs for  $w/(c+p)$  versus 28-day strength.
- c. From the graphs select a  $w/(c+p)$  which will produce a mixture giving a 28-day strength equal to the required strength determined in accordance with the following paragraph.

#### 2.11.4 Average Strength Required for Mixtures

In order to ensure meeting, during production, the strength requirements specified, the mixture proportions selected shall produce a required average strength,  $f'_{cr}$ , exceeding the specified strength,  $f'_c$ , in accordance with procedures in Chapter 3 of ACI 301, "Proportioning."

### PART 3 EXECUTION

#### 3.1 CONDITIONING OF UNDERLYING MATERIAL

Underlying material, subbase course], upon which concrete is to be placed shall be clean, damp, and free from debris, waste concrete or cement, frost, ice, and standing or running water. After the underlying material has been prepared for concrete placement, no equipment shall be permitted thereon.

### 3.2 WEATHER LIMITATIONS

#### 3.2.1 Hot Weather Paving

The temperature of concrete shall not exceed 32 degrees C. Steel forms, dowels and reinforcing shall be cooled prior to concrete placement when steel temperatures are greater than 49 degrees C.

#### 3.2.2 Cold Weather Paving

The ambient temperature of the air at the placing site and the temperature of surfaces to receive concrete shall be not less 5 degrees C. The temperature of the concrete when placed shall be not less than 10 degrees C.

Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Calcium chloride shall not be used at any time. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 10 degrees C for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period. Pavement damaged by freezing shall be completely removed and replaced at the Contractor's expense as specified in paragraph, REPAIR, REMOVAL, AND REPLACEMENT OF SLABS.

### 3.3 CONCRETE PRODUCTION

#### 3.3.1 General Requirements

Concrete shall be deposited in front of the paver within 45 minutes from the time cement has been charged into the mixing drum, except that if the ambient temperature is above 32 degrees C, the time shall be reduced to 30 minutes. Every load of concrete delivered to the paving site shall be accompanied by a batch ticket from the operator of the batching plant. Tickets shall show at least the mass, or volume, of all ingredients in each batch delivered, [the water meter and revolution meter reading on truck mixers] and the time of day. Tickets shall be delivered to the placing foreman who shall keep them on file and deliver them to the Government daily.

#### 3.3.2 Transporting and Transfer-Spreading Operations

Non-agitating equipment shall be used only on smooth roads and for haul time less than 15 minutes. [No equipment shall be allowed to operate on the prepared and compacted underlying material in front of the paver-finisher.

### 3.4 PAVING

Pavement shall be constructed with paving and finishing equipment utilizing [fixed forms.



#### 3.4.1 Consolidation

The paver vibrators shall be inserted into the concrete not closer to the underlying material than 50 mm. The vibrators or any tamping units in front of the paver shall be automatically controlled so that they shall be stopped immediately as forward motion ceases. Excessive vibration shall not be permitted. Concrete in small, odd-shaped slabs or in locations inaccessible to the paver mounted vibration equipment shall be vibrated with a hand-operated immersion vibrator. Vibrators shall not be used to transport or spread the concrete.

#### 3.4.2 Operation

When the paver is operated between or adjacent to previously constructed pavement (fill-in lanes), provisions shall be made to prevent damage to the previously constructed pavement, including keeping the existing pavement surface free of any debris, and placing rubber mats beneath the paver tracks. Transversely oscillating screeds and extrusion plates shall overlap the existing pavement the minimum possible, but in no case more than 200 mm.

#### 3.4.3 Required Results

The paver-finisher shall be operated to produce a thoroughly consolidated slab throughout, true to line and grade within specified tolerances. The paver-finishing operation shall produce a surface finish free of irregularities, tears, voids of any kind, and any other discontinuities. It shall produce only a very minimum of paste at the surface. Multiple passes of the paver-finisher shall not be permitted. The equipment and its operation shall produce a finished surface requiring no hand finishing, other than the use of cutting straightedges, except in very infrequent instances. No water, other than true fog sprays (mist), shall be applied to the concrete surface during paving and finishing.

#### 3.4.4 Fixed Form Paving

Forms shall be steel, except that wood forms may be used for curves having a radius of 45 m or less, and for fillets. Forms may be built up with metal or wood, added only to the base, to provide an increase in depth of not more than 25 percent. The base width of the form shall be not less than eight-tenths of the vertical height of the form, except that forms 200 mm or less in vertical height shall have a base width not less than the vertical height of the form. Wood forms for curves and fillets shall be adequate in strength and rigidly braced. Forms shall be set on firm material cut true to grade so that each form section when placed will be firmly in contact with the underlying layer for its entire base. Forms shall not be set on blocks or on built-up spots of underlying material. [Forms for overlay pavements and for other locations where forms must be set on existing pavements shall be held securely in place with stakes or by other approved methods. Holes in existing pavements for form stakes shall be carefully drilled without cracking or spalling the existing pavement. Prior to setting forms for paving operations, the Contractor shall demonstrate the proposed form setting procedures at an approved location and shall not proceed further until the proposed method is approved.] Forms shall remain in place at least 12 hours after the concrete has been placed.

Forms shall be removed without injuring the concrete.

#### 3.4.5 Placing Reinforcing Steel

Reinforcement shall be positioned on suitable chairs securely fastened to the subgrade prior to concrete placement, or may be placed on an initial layer of consolidated concrete, with the subsequent layer placed within 30 minutes of the first layer placement.

#### 3.4.6 Placing Dowels and Tie Bars

Dowels shall be installed with alignment not greater than 1 mm per 100 mm. Except as otherwise specified below, location of dowels shall be within a horizontal tolerance of plus or minus 15 mm and a vertical tolerance of plus or minus 5 mm. The portion of each dowel intended to move within the concrete or expansion cap shall be painted with one coat of rust inhibiting primer paint, and then oiled just prior to placement. [Dowels] [and tie bars] in joints shall be omitted when the center of the [dowel] [tie bar] is located within a horizontal distance from an intersecting joint equal to or less than one-fourth of the slab thickness.

##### 3.4.6.1 Contraction Joints

[Dowels] [and] [tie bars] in longitudinal and transverse contraction joints within the paving lane shall be held securely in place by means of rigid metal basket assemblies. The [dowels] [and tie bars] shall be welded to the assembly or held firmly by mechanical locking arrangements that will prevent them from becoming distorted during paving operations. The basket assemblies shall be held securely in the proper location by means of suitable anchors.

##### 3.4.6.2 Construction Joints-Fixed Form Paving

Installation of [dowels] [and tie bars] shall be by the bonded-in-place method, supported by means of devices fastened to the forms. Installation by removing and replacing in preformed holes will not be permitted.

##### 3.4.6.3 Dowels Installed in Hardened Concrete

Installation shall be by bonding the dowels into holes drilled into the hardened concrete. Holes approximately 3 mm greater in diameter than the dowels shall be drilled into the hardened concrete. Dowels shall be bonded in the drilled holes using epoxy resin injected at the back of the hole before installing the dowel and extruded to the collar during insertion of the dowel so as to completely fill the void around the dowel. Application by buttering the dowel shall not be permitted. The dowels shall be held in alignment at the collar of the hole, after insertion and before the grout hardens, by means of a suitable metal or plastic collar fitted around the dowel. The vertical alignment of the dowels shall be checked by placing the straightedge on the surface of the pavement over the top of the dowel and measuring the vertical distance between the straightedge and the beginning and ending point of the exposed part of the dowel.

##### 3.4.6.4 Expansion Joints

Dowels in expansion joints shall be installed by the bonded-in-place method or by bonding into holes drilled in hardened concrete, using procedures specified above.

### 3.5 FINISHING

Clary screeds, "bridge deck" finishers, or other rotating pipe or tube type equipment shall not be permitted. The sequence of machine operations shall be transverse finishing, longitudinal machine floating if used, straightedge finishing, texturing, and then edging of joints. Hand finishing shall be used only infrequently and only on isolated areas of odd slab shapes and in the event of a breakdown of the mechanical finishing equipment. Supplemental hand finishing for machine finished pavement shall be kept to an absolute minimum. Equipment to be used for supplemental hand finishing shall primarily be 3 to 4 m cutting straightedges; only very sparing use of bull floats shall be allowed. At no time shall water be added to the surface of the slab in any way, except for fog (mist) sprays to prevent plastic shrinkage cracking.

#### 3.5.1 Machine Finishing With Fixed Forms

The machine shall be designed to ride the forms. Machines that cause displacement of the forms shall be replaced. The machine shall make only one pass over each area of pavement. If the equipment and procedures do not produce a surface of uniform texture, true to grade, in one pass, the operation shall be immediately stopped and the equipment, mixture, and procedures adjusted as necessary.

#### 3.5.2 Surface Correction

While the concrete is still plastic, irregularities and marks in the pavement surface shall be eliminated by means of cutting straightedges, 3 to 4 m in length. Depressions shall be filled with freshly mixed concrete, struck off, consolidated, and refinished. Projections above the required elevation shall also be struck off and refinished. Long-handled, flat "bull floats" shall be used sparingly and only as necessary to correct minor, scattered surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Joints and edges shall not be overfinished.

#### 3.5.3 Hand Finishing

Hand finishing operations shall be used only for those unusual slabs as specified previously. Grate tampers (jitterbugs) shall not be used. As soon as placed and vibrated, the concrete shall be struck off and screeded. The surface shall be tamped with a strike-off and tamping screed, or vibratory screed. Immediately following the final tamping of the surface, the pavement shall be floated longitudinally. Long-handled, flat bull floats shall be used sparingly and only as necessary to correct surface defects. Finishing with hand floats and trowels shall be held to the absolute minimum necessary. Joints and edges shall not be overfinished. No water shall be added to the pavement during finishing operations.

### 3.5.4 Texturing

Before the surface sheen has disappeared and before the concrete hardens, the surface of the pavement shall be given a texture as described herein. Following initial texturing on the first day of placement, the Placing Foreman, Contracting Officer representative, and a representative of the Using Agency shall inspect the texturing for compliance with design requirements. After curing is complete, all textured surfaces shall be thoroughly power broomed to remove all debris. [Any type of transverse texturing shall produce grooves in straight lines across each lane within a tolerance of plus or minus 13 mm of a true line.] The concrete in areas of recesses for tie-down anchors, lighting fixtures, and other outlets in the pavement shall be finished to provide a surface of the same texture as the surrounding area.

#### 3.5.4.1 Fabric-Drag Surface Finish

Surface texture shall be applied by dragging the surface of the pavement, in the direction of the concrete placement, with a moist fabric drag. The dragging shall produce a uniform finished surface having a fine sandy texture without disfiguring marks.

### 3.5.5 Edging

[After texturing has been completed, the edge of the slabs along the forms shall be carefully finished with an edging tool to form a smooth rounded surface of 3 mm radius. No water shall be added to the surface during edging.

### 3.6 CURING

Concrete shall be continuously protected against loss of moisture and rapid temperature changes for at least 7 days from the completion of finishing operations. Unhardened concrete shall be protected from rain and flowing water. During hot weather with low humidity and/or wind, the Contractor shall institute measures to prevent plastic shrinkage cracks from developing. ACI 305R contains means of predicting plastic shrinkage cracking and preventative measures. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry. Curing shall be accomplished by one of the following methods.

#### 3.6.1 Membrane Curing

A uniform coating of white-pigmented membrane-forming curing compound shall be applied to the entire exposed surface of the concrete including pavement edges as soon as the free water has disappeared from the surface after finishing. If evaporation is high and no moisture is present on the surface even though bleeding has not stopped, fog sprays shall be used to keep the surface moist until setting of the cement occurs. Curing compound shall then be immediately applied. Curing compound shall be applied to the finished surfaces by means of a self-propelled automatic spraying machine, equipped with multiple spraying nozzles with wind shields, spanning the newly paved lane. The curing compound shall be applied at a maximum application

rate of 5 square meters per L. The application of curing compound by hand-operated, mechanical powered pressure sprayers will be permitted only on odd widths or shapes of slabs where indicated and on concrete surfaces exposed by the removal of forms. The compound shall form a uniform, continuous, cohesive film that will not check, crack, or peel and that will be free from pinholes and other discontinuities. Areas where the curing compound develops the above defects or is damaged by heavy rainfall, sawing or other construction operations within the curing period, shall be immediately resprayed.

### 3.6.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Impervious sheet curing shall not be used.

## 3.7 JOINTS

No deviation from the jointing pattern shown on the drawings shall be made without written approval of the Design District Pavement or Geotechnical Engineer. All joints shall be straight, perpendicular to the finished grade of the pavement, and continuous from edge to edge or end to end of the pavement with no abrupt offset and no gradual deviation greater than 13 mm.

### 3.7.1 Longitudinal Construction Joints

[Dowels] Tie bars] shall be installed in the longitudinal construction joints, or the edges shall be thickened as indicated.

### 3.7.2 Transverse Construction Joints

Transverse construction joints shall be installed at a planned transverse joint, at the end of each day's placing operations and when concrete placement is interrupted. Transverse construction joints shall be constructed either by utilizing headers and hand placement and finishing techniques, or by placing concrete beyond the transverse construction joint location and then saw cutting full depth and removing concrete back to the transverse construction joint location. For the latter case, dowels shall be installed using methods for dowels installed in hardened concrete described above. All transverse construction joints shall be dowelled.

### 3.7.3 Expansion Joints

Expansion joints shall be formed where indicated, and about any structures and features that project through or into the pavement, using preformed joint filler of the type, thickness, and width indicated, and shall extend the full slab depth. Edges of the concrete at the joint face shall be edged. The joint filler strips shall be installed to form a recess at the pavement surface to be filled with joint sealant. Expansion joints shall be constructed with thickened edges] for load transfer.

### 3.7.4 Slip Joints

Slip joints shall be installed the full depth of the slab using expansion joint preformed joint filler material attached to the face of the original concrete placement. A reservoir for joint sealant shall be constructed at the top of the joint. Edges of the joint face shall be edged.

### 3.7.5 Contraction Joints

Transverse and longitudinal contraction joints shall be of the weakened-plane or dummy type. Longitudinal contraction joints shall be constructed by sawing a groove in the hardened concrete with a power-driven saw. Transverse contraction joints shall be constructed in conformance with requirements for [sawed joints].

#### 3.7.5.1 Sawed Joints

Sawed contraction joints shall be constructed by sawing a groove in the concrete with a 3 mm blade to the indicated depth. The time of initial sawing shall vary depending on existing and anticipated weather conditions and shall be such as to prevent uncontrolled cracking of the pavement. Sawing of the joints shall commence as soon as the concrete has hardened sufficiently to permit cutting the concrete without chipping, spalling, or tearing. The joints shall be sawed at the required spacing consecutively in the sequence of the concrete placement. Sawing at a given joint location shall be discontinued when a crack develops ahead of the saw cut. Immediately after the joint is sawed, the saw cut and adjacent concrete surface shall be thoroughly flushed with water until all waste from sawing is removed from the joint. The surface shall be resprayed with curing compound as soon as free water disappears. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed with cord or backer rod before the concrete in the region of the joint is resprayed with curing compound.

### 3.7.6 Thickened Edge Joints

Underlying material in the transition area shall meet the requirements for smoothness and compaction specified for all other areas of the underlying material.

### 3.7.7 Special Joints

Special joints (undercut joints) shall be constructed adjacent to existing pavement as indicated. The concrete shall be worked under the edge of the existing pavement to completely fill the void and shall be thoroughly consolidated by the use of hand-held vibrators.

## 3.8 REPAIR, REMOVAL, AND REPLACEMENT OF SLABS

New pavement slabs that contain full-depth cracks shall be removed and replaced, as specified herein at no cost to the Government. Removal and replacement shall be full depth, shall be full width of the paving lane, and the limit of removal shall be from each original transverse joint. The Contracting Officer will determine whether cracks extend full depth of the pavement and may require minimum 150 mm diameter cores to be drilled on the

crack to determine depth of cracking. Cores shall be drilled and the hole later filled by the Contractor with a well consolidated concrete mixture bonded to the walls of the hole with epoxy resin. Drilling of cores and refilling holes shall be at no expense to the Government. Cracks that do not extend full depth of slab shall be cleaned and then pressure injected with epoxy resin, Type IV, Grade 1. The Contractor shall ensure that the crack is not widened during epoxy resin injection. Where a full depth crack intersects the original transverse joint, the slab(s) containing the crack shall be removed and replaced, with dowels installed, as required below. Spalls along joints shall be repaired as specified.

### 3.8.1 Removal and Replacement of Full Slabs

Unless there are keys or dowels present, all edges of the slab shall be sawcut full depth. If keys, dowels, or tie bars are present along any edges, these edges shall be sawed full depth 150 mm from the edge if only keys are present, or just beyond the end of dowels or tie bars if they are present. These joints shall then be carefully sawed on the joint line to within 25 mm of the depth of the dowel or key. The main slab shall be further divided by sawing full depth, at appropriate locations, and each piece lifted out and removed. The narrow strips along keyed or doweled edges shall be carefully broken up and removed. Care shall be taken to prevent damage to the dowels, tie bars, or keys or to concrete to remain in place. Protruding portions of dowels shall be painted and lightly oiled. The joint face below keys or dowels shall be suitably trimmed so that there is no abrupt offset. If underbreak occurs at any point along any edge, the area shall be hand-filled with concrete, producing an even joint face from top to bottom, before replacing the removed slab. If underbreak over 100 mm deep occurs, the entire slab containing the underbreak shall be removed and replaced. Where there are no dowels, tie bars, or keys on an edge, or where they have been damaged, dowels of the size and spacing as specified for other joints in similar pavement shall be installed by epoxy grouting them into holes drilled into the existing concrete. Original damaged dowels or tie bars shall be cut off flush with the joint face. All four edges of the new slab shall thus contain dowels or original keys or original tie bars. Prior to placement of new concrete, the underlying material shall be graded and recompact, and the surfaces of all four joint faces shall be cleaned of all loose material and contaminants, and coated with a double application of membrane forming curing compound as bond breaker. Placement of concrete shall be as specified for original construction. The resulting joints around the new slab shall be prepared and sealed as specified.

### 3.8.2 Repairing Spalls Along Joints

Spalls along joints and cracks shall be repaired by first making a vertical saw cut at least 25 mm outside the spalled area and to a depth of at least 50 mm. Saw cuts shall be straight lines forming rectangular areas. The concrete between the saw cut and the joint, or crack, shall be chipped out to remove all unsound concrete. The cavity shall be thoroughly cleaned with high pressure water jets supplemented with compressed air to remove all loose material. Immediately before filling the cavity, a prime coat shall be applied to the dry cleaned surface of all sides and bottom of the cavity, except any joint face. The prime coat shall be applied in a thin coating and scrubbed into the surface with a stiff-bristle brush. Prime coat for

portland cement repairs shall be a neat cement grout and for epoxy resin repairs shall be epoxy resin, Type III, Grade 1. The cavity shall be filled with low slump portland cement concrete or mortar, or with epoxy resin concrete or mortar. Portland cement concrete shall be used for larger spalls, those more than 0.009 cubic meter in size after removal operations; portland cement mortar shall be used for spalls between 0.00085 and 0.009 cubic meter; and epoxy resin mortar or Type III, Grade 3 epoxy resin for those spalls less than 0.00085 cubic meter in size after removal operations.

Portland cement concretes and mortars shall be very low slump mixtures, proportioned, mixed, placed, tamped, and cured. Epoxy resin mortars shall be made with Type III, Grade 1, epoxy resin, using proportions, mixing, placing, tamping and curing procedures as recommended by the manufacturer. Any repair material on the surrounding surfaces of the existing concrete shall be removed before it hardens. Where the spalled area abuts a joint, an insert or other bond-breaking medium shall be used to prevent bond at the joint face. A reservoir for the joint sealant shall be sawed to the dimensions required for other joints.

### 3.8.3 Areas Defective in Plan Grade or Smoothness

In areas not meeting the specified limits for surface smoothness and plan grade, high areas shall be reduced to attain the required smoothness and grade, except as depth is limited below. High areas shall be reduced by grinding the hardened concrete with a surface grinding machine after the concrete is 14 days or more old. The depth of grinding shall not exceed 6 mm. All pavement areas requiring plan grade or surface smoothness corrections in excess of the specified limits, shall be removed and replaced. In pavement areas given a wire comb or tined texture, areas exceeding 2 square meters that have been corrected by rubbing or grinding shall be retextured by grooving machine sawn grooves meeting the requirements for the wire comb or tined texture. All areas in which grinding has been performed will be subject to the thickness tolerances specified in paragraph Thickness. Any grinding performed on individual slabs with excessive deficiencies shall be performed at the Contractor's own decision without entitlement to additional compensation if eventual removal of the slab is required.

### 3.9 EXISTING CONCRETE PAVEMENT REMOVAL AND REPAIR

Existing concrete pavement shall be removed as indicated and as specified in Section 02220 DEMOLITION modified, and expanded as specified herein. Removal, repair and replacement shall be made as indicated and as specified in paragraph REPAIR, REMOVAL, AND REPLACEMENT OR SLABS.

### 3.10 PAVEMENT PROTECTION

The Contractor shall protect the pavement against all damage prior to final acceptance of the work. Traffic shall be excluded from the new pavement. As a construction expedient in paving intermediate lanes between newly paved pilot lanes, operation of the hauling equipment will be permitted on the new pavement after the pavement has been cured for 7 days and the joints have been sealed or otherwise protected. All new and existing pavement carrying construction traffic or equipment shall be continuously kept completely clean. Special cleaning and care shall be used where Contractor's traffic



uses or crosses active airfield pavement.

### 3.11 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL (CQC)

Paragraph ACCEPTABILITY OF WORK contains additional CQC requirements. The Contractor shall perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required and submit reports as specified. When, in the opinion of the Contracting Officer, the paving operation is out of control, concrete placement shall cease.

#### 3.11.1 Batch Plant Control

A daily report shall be prepared indicating checks made for scale accuracy with test weights, checks of batching accuracy, and corrective action taken prior to and during placement for weighing or batching, type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water masses per cubic meter, amount of water as free moisture in each size of aggregate, and the batch aggregate and water masses per cubic meter for each class of concrete batched during each day's plant operation.

#### 3.11.2 Concrete Mixture

- a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two other tests for air content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of paving. Whenever air content reaches specified limits, an immediate confirmatory test shall be made. If the second test also shows air content at or exceeding specified limits, an adjustment shall immediately be made in the amount of air-entraining admixture batched to bring air content within specified limits. If the next adjusted batch of concrete is not within specified limits, concrete placement shall be halted until concrete air content is within specified limits.
- b. Slump Testing. Slump tests shall be made when test specimens are fabricated. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Whenever slump approaches the maximum limit, an adjustment shall immediately be made in the batch masses of water and fine aggregate, without exceeding the maximum  $w/(c+p)$ . When a slump result exceeds the specification limit, no further concrete shall be delivered to the paving site until adjustments have been made and slump is again within the limit.
- c. Temperature. The temperature of the concrete shall be measured when strength specimens are fabricated.
- d. Concrete Strength Testing. Four (4) cylinders from the same batch shall be fabricated, cured and tested for compressive strength, testing two cylinders at 7-day and two cylinders at 28-day age. A minimum of one set of four (4) cylinders shall be fabricated, cured

and tested for each shift of concrete placement. Control charts for strength, showing the 7-day and 28-day CQC compressive strengths, and the 28-day required compressive strength, shall be maintained and submitted with weekly CQC Reports.

#### 3.11.3 Inspection Before Placing

Underlying materials, joint locations and types, construction joint faces, forms, reinforcing, dowels, and embedded items shall be inspected by a Registered Engineer in sufficient time prior to each paving operation in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing, and the certification signed by the Registered Engineer, prior to each days' paving.

#### 3.11.4 Paving Operations

The placing foreman shall supervise all placing and paving operations, shall determine that the correct quality of concrete is placed in each location as shown, shall insure that the concrete is consolidated full depth and that finishing is performed as specified. The placing foreman shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume of concrete placed, and method of paving and any problems encountered.

#### 3.11.5 Curing Inspection

- a. Moist Curing Inspections. Each day on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded. When any inspection finds an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for the area shall be extended by 1 day.
- b. Membrane Curing Inspection. At the end of each day's placement, the CQC Representative shall determine the quantity of compound used by measurement of the container; shall determine the area of concrete surface covered; shall then compute the rate of coverage in square meters per L and shall also note whether or not coverage is uniform. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.

#### 3.11.6 Cold-Weather Protection

At least once per day, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

#### 3.11.7 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report, signed by a

registered engineer, shall be prepared for the updating of control charts and test data, and all CQC inspections and actions covering the entire period from the start of the construction through the current week. Reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all CQC records. A copy of weekly reports shall be faxed to the Design District Pavement or Geotechnical Engineer. At the completion of concrete placement, a certification report shall be prepared containing mix designs, all updated control charts and concrete test data, quality control reports, smoothness reports, and other pertinent data on the concrete, with a certification by a registered engineer that the concrete placed meets all specification requirements. A copy of the certification report shall be mailed to the Design District pavement or Geotechnical Engineer.

-- End of Section --

## SECTION 02760A

FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS  
**03/97**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in this text by the basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 509	(1994) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM D 789	(1998) Determination of Relative Viscosity and Moisture Content of Polyamide (PA)
ASTM D 3405	(1997) Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements
ASTM D 3569	(1995) Joint Sealant, Hot-Applied, Elastomeric, Jet-Fuel-Resistant-Type for Portland Cement Concrete Pavements
ASTM D 5893	(1996) Cold Applied, Single Component Chemically Curing Silicon Joint Sealant for Portland Cement Concrete Pavement

## CORPS OF ENGINEERS (COE)

COE CRD-C 525	(1989) Corps of Engineers Test Method for Evaluation of Hot-Applied Joint Sealants for Bubbling Due to Heating
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## FEDERAL SPECIFICATIONS (FS)

FS SS-S-200	(Rev E; Am 2) Sealant, Joint, Two-Component, Jet-Blast-Resistant, Cold-Applied, for Portland Cement Concrete Pavement
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-03 Product Data

## Manufacturer's Recommendations; G.

Where installation procedures, or any part thereof, are required to be in accordance with the manufacturer's recommendations, printed copies of these recommendations, 30 days prior to use on the project. Installation of the material will not be allowed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

## Construction Equipment List; FIO, RE

List of proposed equipment to be used in performance of construction work including descriptive data, 30 days prior to use on the project.

## SD-04 Samples

## Materials; G

Samples of the materials (sealant, primer if required, and backup material), in sufficient quantity for testing and approval \_\_\_\_\_ days prior to the beginning of work. No material will be allowed to be used until it has been approved.

## 1.3 TEST REQUIREMENTS

The joint sealant and backup or separating material shall be tested for conformance with the referenced applicable material specification. Testing of the materials shall be performed in an approved independent laboratory and certified copies of the test reports shall be submitted and approved \_\_\_\_\_ days prior to the use of the materials at the job site. Samples will be retained by the Government for possible future testing should the materials appear defective during or after application. Conformance with the requirements of the laboratory tests specified will not constitute final acceptance of the materials. Final acceptance will be based on the performance of the in-place materials.

## 1.4 EQUIPMENT

Machines, tools, and equipment used in the performance of the work required by this section shall be approved before the work is started and shall be maintained in satisfactory condition at all times.

## 1.4.1 Joint Cleaning Equipment

## 1.4.1.1 Tractor-Mounted Routing Tool

The routing tool used for removing old sealant from the joints shall be of such shape and dimensions and so mounted on the tractor that it will not damage the sides of the joints. The tool shall be designed so that it can be adjusted to remove the old material to varying depths as required. The use of V-shaped tools or rotary impact routing devices will not be

permitted. Hand-operated spindle routing devices may be used to clean and enlarge random cracks.

#### 1.4.1.2 Concrete Saw

A self-propelled power saw with water-cooled diamond or abrasive saw blades will be provided for cutting joints to the depths and widths specified or for refacing joints or cleaning sawed joints where sandblasting does not provide a clean joint.

#### 1.4.1.3 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hose, and long-wearing venturi-type nozzle of proper size, shape and opening. The maximum nozzle opening should not exceed 6.4 mm. The air compressor shall be portable and shall be capable of furnishing not less than 71 liters per second and maintaining a line pressure of not less than 621 kPa (90 psi) at the nozzle while in use. Compressor capability under job conditions must be demonstrated before approval. The compressor shall be equipped with traps that will maintain the compressed air free of oil and water. The nozzle shall have an adjustable guide that will hold the nozzle aligned with the joint approximately 1 inch above the pavement surface. The height, angle of inclination and the size of the nozzle shall be adjusted as necessary to secure satisfactory results.

#### 1.4.1.4 Hand Tools

Hand tools may be used, when approved, for removing defective sealant from a crack and repairing or cleaning the crack faces.

#### 1.4.2 Sealing Equipment

##### 1.4.2.1 Hot-Poured Sealing Equipment

The unit applicators used for heating and installing ASTM D 3405 ASTM D 3569 joint sealant materials shall be mobile and shall be equipped with a double-boiler, agitator-type kettle with an oil medium in the outer space for heat transfer; a direct-connected pressure-type extruding device with a nozzle shaped for inserting in the joint to be filled; positive temperature devices for controlling the temperature of the transfer oil and sealant; and a recording type thermometer for indicating the temperature of the sealant. The applicator unit shall be designed so that the sealant will circulate through the delivery hose and return to the inner kettle when not in use.

#### 1.5 TRIAL JOINT SEALANT INSTALLATION

Prior to the cleaning and sealing of the joints for the entire project, a test section of at least 60 m long shall be prepared using the specified materials and approved equipment, so as to demonstrate the proposed joint preparation and sealing of all types of joints in the project. Following the completion of the test section and before any other joint is sealed, the test section shall be inspected to determine that the materials and installation meet the requirements specified. If it is determined that the materials or installation do not meet the requirements, the materials shall

be removed, and the joints shall be recleaned and resealed at no cost to the Government. When the test section meets the requirements, it may be incorporated into the permanent work and paid for at the contract unit price per linear foot for sealing items scheduled. All other joints shall be prepared and sealed in the manner approved for sealing the test section.

#### 1.6 DELIVERY AND STORAGE

Materials delivered to the job site shall be inspected for defects, unloaded, and stored with a minimum of handling to avoid damage. Storage facilities shall be provided by the Contractor at the job site for maintaining materials at the temperatures and conditions recommended by the manufacturer.

#### 1.7 ENVIRONMENTAL CONDITIONS

The ambient air temperature and the pavement temperature within the joint wall shall be a minimum of 10 degrees C and rising at the time of application of the materials. Sealant shall not be applied if moisture is observed in the joint.

### PART 2 PRODUCTS

#### 2.1 SEALANTS

Materials for sealing cracks in the various paved areas indicated on the drawings shall be as follows:

Area	Sealing Material
_____	_____
_____	ASTM D 3405 and COE CRD-C 525
_____	FS SS-S-200 Type H
_____	_____

#### 2.2 PRIMERS

Primers, when their use is recommended by the manufacturer of the sealant, shall be as recommended by the manufacturer of the sealant.

#### 2.3 BACKUP MATERIALS

The backup material shall be a compressible, nonshrinking, nonstaining, nonabsorbing material and shall be nonreactive with the joint sealant. The material shall have a melting point at least 3 degrees C greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D 789. The material shall have a water absorption of not more than 5 percent of the sample weight when tested in accordance with ASTM C 509. The backup material shall be 25 plus or minus 5 percent larger in diameter than the nominal width of the crack.

#### 2.4 BOND BREAKING TAPES

The bond breaking tape or separating material shall be a flexible,

nonshrinkable, nonabsorbing, nonstaining, and nonreacting adhesive-backed tape. The material shall have a melting point at least 3 degrees C greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D 789. The bond breaker tape shall be approximately 3 mm wider than the nominal width of the joint and shall not bond to the joint sealant.

### PART 3 EXECUTION

#### 3.1 PREPARATION OF JOINTS

Immediately before the installation of the sealant, the joints shall be thoroughly cleaned to remove all laitance, curing compound, filler, protrusions of hardened concrete, and old sealant from the sides and upper edges of the joint space to be sealed.

##### 3.1.1 Sawing

###### 3.1.1.1 Refacing of Joints

Refacing Facing of joints shall be accomplished using a concrete saw as specified in paragraph EQUIPMENT to remove all residual old sealant and a minimum of concrete from the joint face to provide exposure of newly cleaned concrete, and, if required, to enlarge the joint opening to the width and depth shown on the drawings. The blade shall be stiffened with a sufficient number of suitable dummy (used) blades or washers. Immediately following the sawing operation, the joint opening shall be thoroughly cleaned using a water jet to remove all saw cuttings and debris.

###### 3.1.1.2 Refacing of Random Cracks

Sawing of the cracks shall be accomplished using a power-driven concrete saw as specified in paragraph EQUIPMENT. The saw blade shall be 152 mm or less in diameter to enable the saw to follow the trace of the crack. The blade shall be stiffened as necessary with suitable dummy (or used) blades or washers. Immediately following the sawing operation, the crack opening shall be thoroughly cleaned using a water jet to remove all saw cuttings and debris.

##### 3.1.2 Sandblasting

The newly exposed concrete joint faces and the pavement surfaces extending a minimum of 13 mm from the joint edges shall be sandblasted clean. A multiple-pass technique shall be used until the surfaces are free of dust, dirt, curing compound, filler, old sealant residue, or any foreign debris that might prevent the bonding of the sealant to the concrete. After final cleaning and immediately prior to sealing, the joints shall be blown out with compressed air and left completely free of debris and water.

##### 3.1.3 Back-Up Material

When the joint opening is of a greater depth than indicated for the sealant depth, the lower portion of the joint opening shall be plugged or sealed off using a back-up material to prevent the entrance of the sealant below the



specified depth. Care shall be taken to ensure that the backup material is placed at the specified depth and is not stretched or twisted during installation.

#### 3.1.4 Bond Breaking Tape

Where inserts or filler materials contain bitumen, or the depth of the joint opening does not allow for the use of a backup material, a bond breaker separating tape will be inserted to prevent incompatibility with the filler materials and three-sided adhesion of the sealant. The tape shall be securely bonded to the bottom of the joint opening so it will not float up into the new sealant.

#### 3.1.5 Rate of Progress of Joint Preparation

The stages of joint preparation which include sandblasting, air pressure cleaning and placing of the back-up material shall be limited to only that lineal footage that can be sealed during the same day.

### 3.2 PREPARATION OF SEALANT

#### 3.2.1 Hot-Poured Sealants

Sealants conforming to ASTM D 3405 shall not be heated in excess of the safe heating temperature recommended by the manufacturer as shown on the sealant containers. Sealant that has been overheated or subjected to application temperatures for over 4 hours or that has remained in the applicator at the end of the day's operation shall be withdrawn and wasted.

#### 3.2.2 Type H Sealants

The FS SS-S-200 Type H sealant components shall be mixed either in the container furnished by the manufacturer or a cylindrical metal container of volume approximately 50 percent greater than the package volume. The base material shall be thoroughly mixed in accordance with the manufacturer's instructions. The cure component shall then be slowly added during continued mixing until a uniform consistency is obtained.

#### 3.2.3 Single-Component, Cold-Applied Sealants

The ASTM D 5893 sealant and containers shall be inspected prior to use. Any materials that contain water, hard caking of any separated constituents, nonreversible jell, or materials that are otherwise unsatisfactory shall be rejected. Settlement of constituents in a soft mass that can be readily and uniformly remixed in the field with simple tools will not be cause for rejection.

### 3.3 INSTALLATION OF SEALANT

#### 3.3.1 Time of Application

Joints shall be sealed immediately following final cleaning of the joint walls and following the placement of the separating or backup material. Open joints that cannot be sealed under the conditions specified, or when rain

interrupts sealing operations shall be recleaned and allowed to dry prior to installing the sealant.

### 3.3.2 Sealing Joints

Immediately preceding, but not more than 15 m ahead of the joint sealing operations, a final cleaning with compressed air shall be performed. The joints shall be filled from the bottom up to 6 mm plus or minus 1.5 mm below the pavement surface. Excess or spilled sealant shall be removed from the pavement by approved methods and shall be discarded. The sealant shall be installed in such a manner as to prevent the formation of voids and entrapped air. In no case shall gravity methods or pouring pots be used to install the sealant material. Traffic shall not be permitted over newly sealed pavement until authorized by the Contracting Officer. When a primer is recommended by the manufacturer, it shall be applied evenly to the joint faces in accordance with the manufacturer's instructions. Joints shall be checked frequently to ensure that the newly installed sealant is cured to a tack-free condition within the time specified.

## 3.4 INSPECTION

### 3.4.1 Joint Cleaning

Joints shall be inspected during the cleaning process to correct improper equipment and cleaning techniques that damage the concrete pavement in any manner. Cleaned joints shall be approved prior to installation of the separating or back-up material and joint sealant.

### 3.4.2 Joint Sealant Application Equipment

The application equipment shall be inspected to ensure conformance to temperature requirements, proper proportioning and mixing (if two-component sealant) and proper installation. Evidences of bubbling, improper installation, failure to cure or set shall be cause to suspend operations until causes of the deficiencies are determined and corrected.

### 3.4.3 Joint Sealant

The joint sealant shall be inspected for proper rate of cure and set, bonding to the joint walls, cohesive separation within the sealant, reversion to liquid, entrapped air and voids. Sealants exhibiting any of these deficiencies at any time prior to the final acceptance of the project shall be removed from the joint, wasted, and replaced as specified herein at no additional cost to the Government.

## 3.5 CLEAN-UP

Upon completion of the project, all unused materials shall be removed from the site and the pavement shall be left in a clean condition.

-- End of Section --

## SECTION 02763

## PAVEMENT MARKINGS

09/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 247 (1981) Glass Beads Used in Traffic Paint

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 792 (1991) Density and Specific Gravity (Relative Density) of Plastics by Displacement

ASTM E 28 (1997) Softening Point of Resins by Ring and Ball Apparatus

FEDERAL SPECIFICATIONS (FS)

FS TT-P-1952 (Rev D) Paint, Traffic and Airfield Marking, Waterborne (Metric)

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

SD-03 Product Data

Equipment Lists; GA-AO.

Lists of proposed equipment, including descriptive data, and notifications of proposed Contractor actions as specified in this section. List of

removal equipment shall include descriptive data indicating area of coverage per pass, pressure adjustment range, tank and flow capacities, and safety precautions required for the equipment operation.

#### SD-06 Test Reports

##### Material Tests

Certified copies of the test reports, prior to the use of the materials at the jobsite. Testing shall be performed in an approved independent laboratory.

#### SD-07 Certificates

##### Volatile Organic Compound (VOC) Content

Certificate stating that the proposed pavement marking paint meets the VOC regulations of the local Air Pollution Control District having jurisdiction over the geographical area in which the project is located.

#### SD-08 Manufacturer's Instructions

##### Mixing, Thinning and Application

Manufacturer's current printed product description and Material Safety Data Sheets (MSDS) for each type paint/color proposed for use.

##### Qualifications

Document certifying that personnel are qualified for equipment operation and handling of chemicals.

### 1.3 DELIVERY AND STORAGE

All materials shall be delivered and stored in sealed containers that plainly show the designated name, formula or specification number, batch number, color, date of manufacture, manufacturer's name, and directions, all of which shall be plainly legible at time of use.

### 1.4 EQUIPMENT

All machines, tools and equipment used in the performance of the work shall be approved and maintained in satisfactory operating condition. Equipment operating on roads and runways shall display low speed traffic markings and traffic warning lights.

#### 1.4.1 Paint Application Equipment

The equipment to apply paint to pavements shall be a self-propelled or mobile-drawn pneumatic spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. The machine shall have a speed during application not less than 8 kilometers per hour (5 mph), and shall be capable of applying the stripe widths indicated, at the paint coverage rate specified in paragraph APPLICATION, and of even uniform

thickness with clear-cut edges. Equipment used for marking streets and highways shall be capable of placing the prescribed number of lines at a single pass as solid lines, intermittent lines or a combination of solid and intermittent lines using a maximum of two different colors of paint as specified. The paint applicator shall have paint reservoirs or tanks of sufficient capacity and suitable gauges to apply paint in accordance with requirements specified. Tanks shall be equipped with suitable air-driven mechanical agitators. The spray mechanism shall be equipped with quick-action valves conveniently located, and shall include necessary pressure regulators and gauges in full view and reach of the operator. Paint strainers shall be installed in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator shall be readily adaptable for attachment of an air-actuated dispenser for the reflective media approved for use. Pneumatic spray guns shall be provided for hand application of paint in areas where the mobile paint applicator cannot be used.

#### 1.4.2 Surface Preparation Equipment

##### 1.4.2.1 Sandblasting Equipment

Sandblasting equipment shall include an air compressor, hoses, and nozzles of proper size and capacity as required for cleaning surfaces to be painted.

The compressor shall be capable of furnishing not less than 70.8 liters per sec (150 cfm) of air at a pressure of not less than 620 kPa (90 psi) at each nozzle used, and shall be equipped with traps that will maintain the compressed air free of oil and water.

##### 1.4.2.2 Waterblast Equipment

The water pressure shall be specified at 17.9 MPa (2600 psi) at 60 degrees C (140 degrees F in order to adequately clean the surfaces to be marked.

#### 1.4.3 Traffic Controls

Suitable warning signs shall be placed near the beginning of the worksite and well ahead of the worksite for alerting approaching traffic from both directions. Small markers shall be placed along newly painted lines or freshly placed raised markers to control traffic and prevent damage to newly painted surfaces or displacement of raised pavement markers. Painting equipment shall be marked with large warning signs indicating slow-moving painting equipment in operation.

#### 1.5 HAND-OPERATED, PUSH-TYPE MACHINES

All machines, tools, and equipment used in performance of the work shall be approved and maintained in satisfactory operating condition. Hand-operated push-type machines of a type commonly used for application of paint to pavement surfaces will be acceptable for marking small streets and parking areas. Applicator machine shall be equipped with the necessary paint tanks and spraying nozzles, and shall be capable of applying paint uniformly at coverage specified. Sandblasting equipment shall be provided as required for cleaning surfaces to be painted. Hand-operated spray guns shall be provided for use in areas where push-type machines cannot be used.

## 1.6 MAINTENANCE OF TRAFFIC

### 1.6.1 Roads, Streets, and Parking Areas

When traffic must be rerouted or controlled to accomplish the work, the necessary warning signs, flagpersons, and related equipment for the safe passage of vehicles shall be provided.

## PART 2 PRODUCTS

### 2.1 PAINT

The paint shall be homogeneous, easily stirred to smooth consistency, and shall show no hard settlement or other objectionable characteristics during a storage period of 6 months. Paints for airfields, roads, and streets shall conform to FS TT-P-1952, color as indicated. Pavement marking paints shall comply with applicable state and local laws enacted to ensure compliance with Federal Clean Air Standards. Paint materials shall conform to the restrictions of the local Air Pollution Control District.

### 2.2 SAMPLING AND TESTING

Materials proposed for use shall be stored on the project site in sealed and labeled containers, or segregated at source of supply, sufficiently in advance of needs to allow 60 days for testing. Upon notification by the Contractor that the material is at the site or source of supply, a sample shall be taken by random selection from sealed containers by the Contractor in the presence of a representative of the Contracting Officer. Samples shall be clearly identified by designated name, specification number, batch number, manufacturer's formulation number, project contract number, intended use, and quantity involved. Testing shall be performed in an approved independent laboratory. If materials are approved based on reports furnished by the Contractor, samples will be retained by the Government for possible future testing should the material appear defective during or after application.

## PART 3 EXECUTION

### 3.1 SURFACE PREPARATION

Surfaces to be marked shall be thoroughly cleaned before application of the pavement marking material. Dust, dirt, and other granular surface deposits shall be removed by sweeping, blowing with compressed air, rinsing with water or a combination of these methods as required. Rubber deposits, surface laitance, existing paint markings, and other coatings adhering to the pavement shall be completely removed with scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion as directed. Areas of old pavement affected with oil or grease shall be scrubbed with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinsed thoroughly after each application. After cleaning, oil-soaked areas shall be sealed with cut shellac to prevent bleeding through the new paint. Pavement surfaces shall be allowed to dry, when water is used for cleaning, prior to striping or marking. Surfaces shall be

recleaned, when work has been stopped due to rain.

#### 3.1.1 Pretreatment for Early Painting

Where early painting is required on rigid pavements, a pretreatment with an aqueous solution containing 3 percent phosphoric acid and 2 percent zinc chloride shall be applied to prepared pavement areas prior to painting.

#### 3.1.2 Cleaning Concrete Curing Compounds

On new Portland cement concrete pavements, cleaning operations shall not begin until a minimum of 30 days after the placement of concrete. All new concrete pavements shall be cleaned by either sandblasting or water blasting. When water blasting is performed, thermoplastic and preformed markings shall be applied no sooner than 24 hours after the blasting has been completed. The extent of the blasting work shall be to clean and prepare the concrete surface as follows:

a. There is no visible evidence of curing compound on the peaks of the textured concrete surface.

b. There are no heavy puddled deposits of curing compound in the valleys of the textured concrete surface.

c. All remaining curing compound is intact; all loose and flaking material is removed.

d. The peaks of the textured pavement surface are rounded in profile and free of sharp edges and irregularities.

e. The surface to be marked is dry.

### 3.2 APPLICATION

All pavement markings and patterns shall be placed as shown on the plans.

#### 3.2.1 Paint

Paint shall be applied to clean, dry surfaces, and only when air and pavement temperatures are above 5 degrees C and less than 35 degrees C. Paint temperature shall be maintained within these same limits. New asphalt pavement surfaces and new Portland concrete cement shall be allowed to cure for a period of not less than 30 days before applications of paint. Paint shall be applied pneumatically with approved equipment at rate of coverage specified. The Contractor shall provide guide lines and templates as necessary to control paint application. Special precautions shall be taken in marking numbers, letters, and symbols. Edges of markings shall be sharply outlined.

##### 3.2.1.1 Rate of Application

a. Nonreflective Markings: Paint shall be applied evenly to the pavement surface to be coated at a rate of 2.9 plus or minus 0.5 square meter per liter.

### 3.2.1.2 Drying

The maximum drying time requirements of the paint specifications will be strictly enforced to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. If there is a delay in drying of the markings, painting operations shall be discontinued until cause of the slow drying is determined and corrected.

### 3.2.2 Preformed Tape

The pavement surface temperature shall be a minimum of 15 degrees C and the ambient temperature shall be a minimum of 15 degrees C and rising. The preformed markings shall be placed in accordance with the manufacturer's written instructions.

### 3.2.3 Raised Reflective Markers

Prefabricated markers shall be aligned carefully at the required spacing and permanently fixed in place by means of epoxy resin adhesives. To insure good bond, pavement in areas where markers will be set shall be thoroughly cleaned by sandblasting and use of compressed air prior to applying adhesive.

### 3.2.4 Reflective Media

Application of reflective media shall immediately follow application of pigmented binder. Drop-on application of glass spheres shall be accomplished to insure that reflective media is evenly distributed at the specified rate of coverage. Should there be malfunction of either paint applicator or reflective media dispenser, operations shall be discontinued immediately until deficiency is corrected.

## 3.3 MARKING REMOVAL

Pavement marking, including plastic tape, shall be removed in the areas shown on the drawings. Removal of marking shall be as complete as possible without damage to the surface. Aggregate shall not be exposed by the removal process. After the markings are removed, the cleaned pavement surfaces shall exhibit adequate texture for remarking as specified in paragraph SURFACE PREPARATION. Contractor shall demonstrate removal of pavement marking in an area designated by the Contracting Officer. The demonstration area will become the standard for the remainder of the work.

### 3.3.1 Equipment Operation

Equipment shall be controlled and operated to remove markings from the pavement surface, prevent dilution or removal of binder from underlying pavement, and prevent emission of blue smoke from asphalt or tar surfaces.

### 3.3.2 Cleanup and Waste Disposal

The worksite shall be kept clean of debris and waste from the removal operations. Cleanup shall immediately follow removal operations in areas subject to air traffic. Debris shall be disposed of at approved sites.



-- End of Section --

## SECTION 02770

CONCRETE SIDEWALKS AND CURBS AND GUTTERS  
03/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 182 (1991) Burlap Cloth Made from Jute or Kenaf

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 185 (1997) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement

ASTM A 615/A 615M (1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

ASTM A 616/A 616M (1996a) Rail-Steel Deformed and Plain Bars for Concrete Reinforcement

ASTM A 617/A 617M (1996a) Axle-Steel Deformed and Plain Bars for Concrete Reinforcement

ASTM C 31/C 31M (1996) Making and Curing Concrete Test Specimens in the Field

ASTM C 143 (1990a) Slump of Hydraulic Cement Concrete

ASTM C 171 (1997) Sheet Materials for Curing Concrete

ASTM C 172 (1997) Sampling Freshly Mixed Concrete

ASTM C 173 (1996) Air Content of Freshly Mixed Concrete by the Volumetric Method

ASTM C 231 (1997) Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C 309 (1997) Liquid Membrane-Forming Compounds for Curing Concrete

ASTM C 494	Chemical Admixtures for Concrete
ASTM C 920	(1995) Elastomeric Joint Sealants
ASTM D 1751	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 3405	(1996) Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-03 Product Data

#### Concrete

Copies of certified delivery tickets for all concrete used in the constructions.

#### Color Mixer

Copies of concrete color mixer data which includes the make, type, quantities and color sample of concrete color mixers proposed for mixing with concrete.

### SD-06 Test Reports

#### Field Quality Control

Copies of all test reports within 24 hours of completion of the test which show that proportions thus selected will produce concrete of the qualities indicated. No substitutions will be made in the source or type of materials used in the work without additional tests to show that the quality of the new materials and concrete are satisfactory.

## 1.3 WEATHER LIMITATIONS

### 1.3.1 Placing During Cold Weather

Concrete placement shall not take place when the air temperature reaches 5 degrees C and is falling, or is already below that point. Placement may

begin when the air temperature reaches 2 degrees C and is rising, or is already above 5 degrees C. Provisions shall be made to protect the concrete from freezing during the specified curing period. If necessary to place concrete when the temperature of the air, aggregates, or water is below 2 degrees C, placement and protection shall be approved in writing. Approval will be contingent upon full conformance with the following provisions. The underlying material shall be prepared and protected so that it is entirely free of frost when the concrete is deposited. Mixing water and aggregates shall be heated as necessary to result in the temperature of the in-place concrete being between 10 and 30 degrees C. Methods and equipment for heating shall be approved. The aggregates shall be free of ice, snow, and frozen lumps before entering the mixer. Covering and other means shall be provided for maintaining the concrete at a temperature of at least 10 degrees C for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period.

#### 1.3.2 Placing During Warm Weather

The temperature of the concrete as placed shall not exceed 30 degrees C except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. The placing temperature shall not exceed 35 degrees C at any time.

### 1.4 PLANT, EQUIPMENT, MACHINES, AND TOOLS

#### 1.4.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in a satisfactory working condition at all times. The equipment shall have the capability of producing the required product, meeting grade controls, thickness control and smoothness requirements as specified. Use of the equipment shall be discontinued if it produces unsatisfactory results. The Contracting Officer shall have access at all times to the plant and equipment to ensure proper operation and compliance with specifications.

#### 1.4.2 Slip Form Equipment

Slip form paver or curb forming machine, will be approved based on trial use on the job and shall be self-propelled, automatically controlled, crawler mounted, and capable of spreading, consolidating, and shaping the plastic concrete to the desired cross section in 1 pass.

## PART 2 PRODUCTS

### 2.1 CONCRETE

Concrete shall conform to the applicable requirements of except as otherwise specified. Concrete shall have a minimum compressive strength of 24 MPa at 28 days. Maximum size of aggregate shall be 37.5 mm.

#### 2.1.1 Air Content

Mixtures shall have air content by volume of concrete of 5 to 7 percent, based on measurements made immediately after discharge from the mixer.

#### 2.1.2 Slump

The concrete slump shall be 50 mm plus or minus 25 mm where determined in accordance with ASTM C 143.

#### 2.1.3 Reinforcement Steel

Reinforcement bars shall conform to ASTM A 615/A 615M, ASTM A 616/A 616M, or ASTM A 617/A 617M. Wire mesh reinforcement shall conform to ASTM A 185.

### 2.2 CONCRETE CURING MATERIALS

#### 2.2.1 Impervious Sheet Materials

Impervious sheet materials shall conform to ASTM C 171, type optional, except that polyethylene film, if used, shall be white opaque.

#### 2.2.2 Burlap

Burlap shall conform to AASHTO M 182.

#### 2.2.3 White Pigmented Membrane-Forming Curing Compound

White pigmented membrane-forming curing compound shall conform to ASTM C 309, Type 2.

### 2.3 CONCRETE PROTECTION MATERIALS

Concrete protection materials shall be a linseed oil mixture of equal parts, by volume, of linseed oil and either mineral spirits, naphtha, or turpentine. At the option of the contractor, commercially prepared linseed oil mixtures, formulated specifically for application to concrete to provide protection against the action of deicing chemicals may be used, except that emulsified mixtures are not acceptable.

### 2.4 JOINT FILLER STRIPS

#### 2.4.1 Contraction Joint Filler for Curb and Gutter

Contraction joint filler for curb and gutter shall consist of hard-pressed fiberboard.

#### 2.4.2 Expansion Joint Filler, Premolded

Expansion joint filler, premolded, shall conform to ASTM D 1751 or ASTM D 1752, 10 mm thick, unless otherwise indicated.

### 2.5 JOINT SEALANTS

#### 2.5.1 Joint Sealant, Cold-Applied

Joint sealant, cold-applied shall conform to ASTM C 920.

#### 2.5.2 Joint Sealant, Hot-Poured

Joint sealant, hot-poured shall conform to ASTM D 3405.

### 2.6 FORM WORK

Form work shall be designed and constructed to ensure that the finished concrete will conform accurately to the indicated dimensions, lines, and elevations, and within the tolerances specified. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete. Wood forms shall be surfaced plank, 50 mm nominal thickness, straight and free from warp, twist, loose knots, splits or other defects. Wood forms shall have a nominal length of 3 m. Radius bends may be formed with 19 mm boards, laminated to the required thickness. Steel forms shall be channel-formed sections with a flat top surface and with welded braces at each end and at not less than two intermediate points. Ends of steel forms shall be interlocking and self-aligning. Steel forms shall include flexible forms for radius forming, corner forms, form spreaders, and fillers. Steel forms shall have a nominal length of 3 m with a minimum of 3 welded stake pockets per form. Stake pins shall be solid steel rods with chamfered heads and pointed tips designed for use with steel forms.

#### 2.6.1 Sidewalk Forms

Sidewalk forms shall be of a height equal to the full depth of the finished sidewalk.

#### 2.6.2 Curb and Gutter Forms

Curb and gutter outside forms shall have a height equal to the full depth of the curb or gutter. The inside form of curb shall have batter as indicated and shall be securely fastened to and supported by the outside form. Rigid forms shall be provided for curb returns, except that benders or thin plank forms may be used for curb or curb returns with a radius of 3 m or more, where grade changes occur in the return, or where the central angle is such that a rigid form with a central angle of 90 degrees cannot be used. Back forms for curb returns may be made of 38 mm benders, for the full height of the curb, cleated together. In lieu of inside forms for curbs, a curb "mule" may be used for forming and finishing this surface, provided the results are approved.

### 2.7 COLOR MIXERS

Color mixers for concrete shall be the product of a manufacturer regularly engaged in the production of colored admixtures for concrete, and shall have a history of at least 2 years of use of the material in a similar environments without substantial fading or deleterious effects on the structural qualities of the concrete. Color mixers must be capable of evenly distributing the color throughout the concrete without segregation or causing irregular concentration of color. The pigment portion of the colored mixer shall comply with ASTM C 979. The dye shall be clearly

visible on the concrete surface for at least 4 hours after application, but shall become inconspicuous within 7 days. The color mixer shall produce a colored concrete which matches CHROMIX admixture color C-11, Desert Sand. The job mix formula shall be the responsibility of the contractor. The manufacturer of the color mixer shall provide assistance to the contractor in the development of the job-mix formula using the materials specified elsewhere in these specifications. The color mixer shall be batched in a manner that will ensure that the mixer is completely and thoroughly mixed throughout the concrete. Quantities of the mixer added to the concrete shall be controlled to avoid variations in color between adjacent placements as well as maintaining a consistent coloring throughout the project area.

### PART 3 EXECUTION

#### 3.1 SUBGRADE PREPARATION

The subgrade shall be constructed to the specified grade and cross section prior to concrete placement. Subgrade shall be placed and compacted in conformance with Section 02800, "EARTHWORK."

##### 3.1.1 Sidewalk Subgrade

The subgrade shall be tested for grade and cross section with a template extending the full width of the sidewalk and supported between side forms.

##### 3.1.2 Curb and Gutter Subgrade

The subgrade shall be tested for grade and cross section by means of a template extending the full width of the curb and gutter. The subgrade shall be of materials equal in bearing quality to the subgrade under the adjacent pavement.

##### 3.1.3 Maintenance of Subgrade

The subgrade shall be maintained in a smooth, compacted condition in conformity with the required section and established grade until the concrete is placed. The subgrade shall be in a moist condition when concrete is placed. The subgrade shall be prepared and protected to produce a subgrade free from frost when the concrete is deposited.

#### 3.2 FORM SETTING

Forms shall be set to the indicated alignment, grade and dimensions. Forms shall be held rigidly in place by a minimum of 3 stakes per form placed at intervals not to exceed 1.2 meters. Corners, deep sections, and radius bends shall have additional stakes and braces, as required. Clamps, spreaders, and braces shall be used where required to ensure rigidity in the forms. Forms shall be removed without injuring the concrete. Bars or heavy tools shall not be used against the concrete in removing the forms. Any concrete found defective after form removal shall be promptly and satisfactorily repaired. Forms shall be cleaned and coated with form oil each time before concrete is placed. Wood forms may, instead, be thoroughly wetted with water before concrete is placed, except that with probable freezing temperatures, oiling is mandatory.

### 3.2.1 Sidewalks

Forms for sidewalks shall be set with the upper edge true to line and grade with an allowable tolerance of 3 mm in any 3 m long section. After forms are set, grade and alignment shall be checked with a 3 m straightedge. Forms shall have a transverse slope as indicated with the low side adjacent to the roadway. Side forms shall not be removed for 12 hours after finishing has been completed.

### 3.2.2 Curbs and Gutters

The forms of the front of the curb shall be removed not less than 2 hours nor more than 6 hours after the concrete has been placed. Forms back of curb shall remain in place until the face and top of the curb have been finished, as specified for concrete finishing. Gutter forms shall not be removed while the concrete is sufficiently plastic to slump in any direction.

## 3.3 SIDEWALK CONCRETE PLACEMENT AND FINISHING

### 3.3.1 Formed Sidewalks

Concrete shall be placed in the forms in one layer. When consolidated and finished, the sidewalks shall be of the thickness indicated. After concrete has been placed in the forms, a strike-off guided by side forms shall be used to bring the surface to proper section to be compacted. The concrete shall be consolidated with an approved vibrator, and the surface shall be finished to grade with a strike off.

### 3.3.2 Concrete Finishing

After straight edging, when most of the water sheen has disappeared, and just before the concrete hardens, the surface shall be finished with a wood float or darby to a smooth and uniformly fine granular or sandy texture free of waves, irregularities, or tool marks. A scored surface shall be produced by brooming with a fiber-bristle brush in a direction transverse to that of the traffic, followed by edging.

### 3.3.3 Edge and Joint Finishing

All slab edges, including those at formed joints, shall be finished with an edger having a radius of 3 mm. Transverse joint shall be edged before brooming, and the brooming shall eliminate the flat surface left by the surface face of the edger. Corners and edges which have crumbled and areas which lack sufficient mortar for proper finishing shall be cleaned and filled solidly with a properly proportioned mortar mixture and then finished.

### 3.3.4 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 8 mm from the testing edge of a 3 m straightedge. Permissible deficiency in section thickness will be up to 6 mm.

### 3.3.5 Colored Concrete



When colored concrete is to be pumped, the priming slurry for the host must be colored with the color mixer. Surfaces shall be cleaned to remove any residual color that bleeds from the concrete. After cleaning, colored concrete shall be given one coat of surface sealer, spray applied in accordance with manufacturers recommendations. Adjacent surfaces shall be protected during sealing. Colors of pigmented concrete shall be considered satisfactory based on the comparative analysis of color produced versus the approved sample.

### 3.4 CURB AND GUTTER CONCRETE PLACEMENT AND FINISHING

#### 3.4.1 Formed Curb and Gutter

Concrete shall be placed to the section required in a single lift. Consolidation shall be achieved by using approved mechanical vibrators. Curve shaped gutters shall be finished with a standard curb "mule".

#### 3.4.2 Curb and Gutter Finishing

Approved slip formed curb and gutter machines may be used in lieu of hand placement.

#### 3.4.3 Concrete Finishing

Exposed surfaces shall be floated and finished with a smooth wood float until true to grade and section and uniform in texture. Floated surfaces shall then be brushed with a fine-hair brush with longitudinal strokes. The edges of the gutter and top of the curb shall be rounded with an edging tool to a radius of 13 mm. Immediately after removing the front curb form, the face of the curb shall be rubbed with a wood or concrete rubbing block and water until blemishes, form marks, and tool marks have been removed. The front curb surface, while still wet, shall be brushed in the same manner as the gutter and curb top. The top surface of gutter and entrance shall be finished to grade with a wood float.

#### 3.4.4 Joint Finishing

Curb edges at formed joints shall be finished as indicated.

#### 3.4.5 Surface and Thickness Tolerances

Finished surfaces shall not vary more than 6 mm from the testing edge of a 3 m straightedge. Permissible deficiency in section thickness will be up to 6 mm.

### 3.5 SIDEWALK JOINTS

Sidewalk joints shall be constructed to divide the surface into rectangular areas. Transverse contraction joints shall be spaced as indicated and shall be continuous across the slab. Longitudinal contraction joints shall be constructed along the centerline of all sidewalks as indicated.. Transverse expansion joints shall be installed at sidewalk returns and opposite expansion joints in adjoining curbs. Where the sidewalk is not in contact

with the curb, transverse expansion joints shall be installed as indicated. Expansion joints shall be formed about structures and features which project through or into the sidewalk pavement, using joint filler of the type, thickness, and width indicated.

#### 3.5.1 Sidewalk Contraction Joints

The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the slab to a depth of at least one-fourth of the sidewalk slab thickness, using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove in the concrete with a 3 mm blade to the depth indicated. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operations.

#### 3.5.2 Sidewalk Expansion Joints

Expansion joints shall be formed with 13 mm joint filler strips. Joint filler shall be placed with top edge 6 mm below the surface and shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 3 mm, and concrete over the joint filler shall be removed. At the end of the curing period, expansion joints shall be cleaned and filled with joint sealant. Joints shall be sealed as specified in Section 02760 FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS.

### 3.6 CURB AND GUTTER JOINTS

Curb and gutter joints shall be constructed at right angles to the line of curb and gutter.

#### 3.6.1 Contraction Joints

Contraction joints shall be constructed directly opposite contraction joints in abutting portland cement concrete pavements and spaced so that monolithic sections between curb returns will not be less than 1.5 m nor greater than 4.5 m in length. Contraction joints shall be constructed by means of 3 mm thick separators and of a section conforming to the cross section of the curb and gutter. Separators shall be removed as soon as practicable after concrete has set sufficiently to preserve the width and shape of the joint and prior to finishing.

#### 3.6.2 Expansion Joints

Expansion joints shall be formed by means of preformed expansion joint filler material cut and shaped to the cross section of curb and gutter. Expansion joints shall be provided in curb and gutter directly opposite expansion joints of abutting portland cement concrete pavement, and shall be of the same type and thickness as joints in the pavement. Where curb and gutter do not abut portland cement concrete pavement, expansion joints at least 13 mm in width shall be provided at intervals not exceeding 35 meters.

Expansion joints shall be provided in nonreinforced concrete gutter at locations indicated. Expansion joints shall be sealed immediately following curing of the concrete or as soon thereafter as weather conditions permit. Joints shall be sealed as specified in Section 02760 FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS.

### 3.7 CURING AND PROTECTION

#### 3.7.1 General Requirements

Concrete shall be protected against loss of moisture and rapid temperature changes for at least 7 days from the beginning of the curing operation. Unhardened concrete shall be protected from rain and flowing water. All equipment needed for adequate curing and protection of the concrete shall be on hand and ready for use before actual concrete placement begins. Protection shall be provided as necessary to prevent cracking of the pavement due to temperature changes during the curing period.

##### 3.7.1.1 Mat Method

The entire exposed surface shall be covered with 2 or more layers of burlap. Mats shall overlap each other at least 150 mm. The mat shall be thoroughly wetted with water prior to placing on concrete surface and shall be kept continuously in a saturated condition and in intimate contact with concrete for not less than 7 days.

##### 3.7.1.2 Impervious Sheeting Method

The entire exposed surface shall be wetted with a fine spray of water and then covered with impervious sheeting material. Sheets shall be laid directly on the concrete surface with the light-colored side up and overlapped 300 mm when a continuous sheet is not used. The curing medium shall not be less than 450 mm wider than the concrete surface to be cured, and shall be securely weighted down by heavy wood planks, or a bank of moist earth placed along edges and laps in the sheets. Sheets shall be satisfactorily repaired or replaced if torn or otherwise damaged during curing. The curing medium shall remain on the concrete surface to be cured for not less than 7 days.

##### 3.7.1.3 Membrane Curing Method

A uniform coating of white-pigmented membrane-curing compound shall be applied to the entire exposed surface of the concrete as soon after finishing as the free water has disappeared from the finished surface. Formed surfaces shall be coated immediately after the forms are removed and in no case longer than 1 hour after the removal of forms. Concrete shall not be allowed to dry before the application of the membrane. If any drying has occurred, the surface of the concrete shall be moistened with a fine spray of water and the curing compound applied as soon as the free water disappears. Curing compound shall be applied in two coats by hand-operated pressure sprayers at a coverage of approximately 5 square meters per liter (200 square feet per gallon) for the total of both coats. The second coat shall be applied in a direction approximately at right angles to the direction of application of the first coat. The compound shall form a

uniform, continuous, coherent film that will not check, crack, or peel and shall be free from pinholes or other imperfections. If pinholes, abrasion, or other discontinuities exist, an additional coat shall be applied to the affected areas within 30 minutes. Concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied shall be resprayed by the method and at the coverage specified above. Areas where the curing compound is damaged by subsequent construction operations within the curing period shall be resprayed. Necessary precautions shall be taken to insure that the concrete is properly cured at sawed joints, and that no curing compound enters the joints. The top of the joint opening and the joint groove at exposed edges shall be tightly sealed before the concrete in the region of the joint is resprayed with curing compound. The method used for sealing the joint groove shall prevent loss of moisture from the joint during the entire specified curing period. Approved standby facilities for curing concrete pavement shall be provided at a location accessible to the jobsite for use in the event of mechanical failure of the spraying equipment or other conditions that might prevent correct application of the membrane-curing compound at the proper time. Concrete surfaces to which membrane-curing compounds have been applied shall be adequately protected during the entire curing period from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

#### 3.7.2 Backfilling

After curing, debris shall be removed and the area adjoining the concrete shall be backfilled, graded, and compacted to conform to the surrounding area in accordance with lines and grades indicated.

#### 3.7.3 Protection

Completed concrete shall be protected from damage until accepted. The Contractor shall repair damaged concrete and clean concrete discolored during construction. Concrete that is damaged shall be removed and reconstructed for the entire length between regularly scheduled joints. Refinishing the damaged portion will not be acceptable. Removed damaged portions shall be disposed of as directed.

#### 3.7.4 Protective Coating

Protective coating of linseed oil mixture shall be applied to the exposed-to-view concrete surface.

##### 3.7.4.1 Application

Curing and backfilling operation shall be completed prior to applying two coats of protective coating. Concrete shall be surface dry and clean before each application. Coverage shall be by spray application at not more than 11 square meters per liter (50 square yards per gallon) for first application and not more than 15.5 square meters per liter (70 square yards per gallon) for second application, except that the number of applications and coverage for each application for commercially prepared mixture shall be in accordance with the manufacturer's instructions. Coated surfaces shall be

protected from vehicular and pedestrian traffic until dry.

#### 3.7.4.2 Precautions

Protective coating shall not be heated by direct application of flame or electrical heaters and shall be protected from exposure to open flame, sparks, and fire adjacent to open containers or applicators. Material shall not be applied at ambient or material temperatures lower than 10 degrees C.

### 3.8 FIELD QUALITY CONTROL

#### 3.8.1 General Requirements

The Contractor shall perform the inspection and tests described and meet the specified requirements for inspection details and frequency of testing. Based upon the results of these inspections and tests, the Contractor shall take the action and submit reports as required below, and any additional tests to insure that the requirements of these specifications are met.

#### 3.8.2 Concrete Testing

##### 3.8.2.1 Strength Testing

The Contractor shall provide molded concrete specimens for strength tests. Samples of concrete placed each day shall be taken not less than once a day nor less than once for every 190 cubic meters of concrete. The samples for strength tests shall be taken in accordance with ASTM C 172. Cylinders for acceptance shall be molded in conformance with ASTM C 31/C 31M by an approved testing laboratory. Each strength test result shall be the average of 2 test cylinders from the same concrete sample tested at 28 days, unless otherwise specified or approved. Concrete specified on the basis of compressive strength will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength, and no individual strength test result falls below the specified strength by more than 4 MPa.

##### 3.8.2.2 Air Content

Air content shall be determined in accordance with ASTM C 173 or ASTM C 231. ASTM C 231 shall be used with concretes and mortars made with relatively dense natural aggregates. Two tests for air content shall be made on randomly selected batches of each class of concrete placed during each shift. Additional tests shall be made when excessive variation in concrete workability is reported by the placing foreman or the Government inspector. If results are out of tolerance, the placing foreman shall be notified and he shall take appropriate action to have the air content corrected at the plant. Additional tests for air content will be performed on each truckload of material until such time as the air content is within the tolerance specified.

##### 3.8.2.3 Slump Test

Two slump tests shall be made on randomly selected batches of each class of concrete for every 190 cubic meters, or fraction thereof, of concrete placed

during each shift. Additional tests shall be performed when excessive variation in the workability of the concrete is noted or when excessive crumbling or slumping is noted along the edges of slip-formed concrete.

### 3.8.3 Thickness Evaluation

The anticipated thickness of the concrete shall be determined prior to placement by passing a template through the formed section or by measuring the depth of opening of the extrusion template of the curb forming machine. If a slip form paver is used for sidewalk placement, the subgrade shall be true to grade prior to concrete placement and the thickness will be determined by measuring each edge of the completed slab.

### 3.8.4 Surface Evaluation

The finished surface of each category of the completed work shall be uniform in color and free of blemishes and form or tool marks.

## 3.9 SURFACE DEFICIENCIES AND CORRECTIONS

### 3.9.1 Thickness Deficiency

When measurements indicate that the completed concrete section is deficient in thickness by more than 6 mm the deficient section will be removed, between regularly scheduled joints, and replaced.

### 3.9.2 High Areas

In areas not meeting surface smoothness and plan grade requirements, high areas shall be reduced either by rubbing the freshly finished concrete with carborundum brick and water when the concrete is less than 36 hours old or by grinding the hardened concrete with an approved surface grinding machine after the concrete is 36 hours old or more. The area corrected by grinding the surface of the hardened concrete shall not exceed 5 percent of the area of any integral slab, and the depth of grinding shall not exceed 6 mm. Pavement areas requiring grade or surface smoothness corrections in excess of the limits specified above shall be removed and replaced.

### 3.9.3 Appearance

Exposed surfaces of the finished work will be inspected by the Government and any deficiencies in appearance will be identified. Areas which exhibit excessive cracking, discoloration, form marks, or tool marks or which are otherwise inconsistent with the overall appearances of the work shall be removed and replaced.

-- End of Section --

## SECTION 02832

SEGMENTAL CONCRETE BLOCK RETAINING WALL  
**08/99**

## PART 1 GENERAL

This work element includes engineering services in addition to the construction requirements. The Contractor is responsible for engineering services that include design of the wall in accordance with the National Concrete Masonry Association design method, and providing shop drawings indicating all features of the complete design.

## 1.1 REFERENCES

The publications listed below form a part of the specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 252	(1996) Corrugated Polyethylene Drainage Tubing
AASHTO M 288	(1996) Geotextiles Used for Subsurface Drainage Purposes

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 140	(1997) Sampling and Testing Concrete Masonry Units
ASTM C 920	(1998) Elastomeric Joint Sealants
ASTM C 1262	(1997) Evaluating the Freeze-Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units
ASTM C 1372	(1997) Segmental Retaining Wall Units
ASTM D 448	(1986; R 1993) Sizes of Aggregate for Road and Bridge Construction
ASTM D 698	(1998) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))
ASTM D 1241	(1968; R 1994) Materials for Soil-Aggregate Subbase, Base, and Surface Courses

ASTM D 1556	(1990; R 1996) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 2487	(1993) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 2488	(1993) Description and Identification of Soils (Visual-Manual Procedure)
ASTM D 2922	(1996) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 4355	(1992) Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus)
ASTM D 4491	(1996) Water Permeability of Geotextiles by Permittivity
ASTM D 4595	(1986; R 1994) Tensile Properties of Geotextiles by the Wide-Width Strip Method
ASTM D 4632	(1991; R 1996) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4751	(1995) Determining Apparent Opening Size of a Geotextile
ASTM D 4873	(1997) Identification, Storage, and Handling of Geosynthetic Rolls
ASTM D 5321	(1992) Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method

## FEDERAL HIGHWAY ADMINISTRATION (FHWA)

FHWA SA-96-071	(1997) Mechanically Stabilized Earth Walls and Reinforced Soil Slopes: Design and Construction Guidelines
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## GEOSYNTHETIC INSTITUTE (GSI)

GSI GRI GG1	(1988) Geogrid Rib Tensile Strength
GSI GRI GG5	(1991) Geogrid Pullout
GSI GRI GG6	(1992) Grip Types for Use in the Wide Width Testing of Geotextiles and Geogrids
GSI GRI GT6	(1992) Geotextile Pullout

## NATIONAL CONCRETE MASONRY ASSOCIATION (NCMA)



NCMA SRWU-1	(1997) Determination of Connection Strength between Geosynthetics and Segmental Concrete Units
NCMA SRWU-2	(1997) Determination of Shear Strength between Segmental Concrete Units
NCMA SRW Manual	(1997) Design Manual for Segmental Retaining Walls, 2nd Edition
NCMA Seismic Manual	(1998) Segmental Retaining Walls - Seismic Design Manual, 1st Edition

## 1.2 DEFINITIONS

- a. Blocks. Segmental concrete retaining wall units will be referred to as blocks.
- b. Drainage Aggregate. Granular soil or aggregate which is placed within, between, and/or immediately behind segmental concrete units.
- c. Fill. Soil or aggregate placed in, behind, or below the wall will be referred to as fill.
- d. Reinforced Fill. Soil which is placed and compacted within the neat line volume of reinforcement as outlined on the plans.
- e. Retained Fill. Soil which is placed and compacted behind the reinforced fill.
- f. Reinforcement. Reinforcement shall consist of a geogrid or a geotextile product manufactured for use as reinforcing. Reinforcement shall not include steel products.
- g. Long Term Design Strength. The long term design strength (LTDS) is:

$$LTDS = T_{ult} / (RF_{CD} * RF_{LD} * RF_{CR})$$

where:

- $T_{ult}$  is the ultimate strength
- $RF_{CD}$  is the reduction factor for chemical and biological durability
- $RF_{LD}$  is the reduction factor for installation damage
- $RF_{CR}$  is the reduction factor for creep

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

## Shop Drawings; GA-KC

The fabrication and installation drawings shall be submitted. The shop drawings shall include all items described under paragraph SEGMENTAL RETAINING WALL DESIGN.

## SD-03 Product Data

## Manufacturer's Data

The Contractor shall submit descriptive technical data on the blocks, wall caps, masonry adhesive, reinforcement and geotextile filter materials. The submittal shall include all material properties specified under paragraph PRODUCTS. The submittal shall also include a copy of any standard manufacturer's warranties for the products.

## Test Data

The Contractor shall submit testing data specific to the blocks and reinforcement to be supplied.

- a. The shear strength between blocks shall be established in accordance with NCMA SRWU-2.
- b. The connection strength between the blocks and the reinforcement shall be established in accordance with NCMA SRWU-1. If the FHWA design method is used, the modifications in FHWA SA-96-071 shall be implemented.
- c. The coefficient for direct shear of the reinforcement on a soil similar in gradation and texture to the material that will be used for fill in the reinforced zone shall be established in accordance with ASTM D 5321.
- d. The coefficient of interaction for pull-out resistance of the reinforcement in a soil similar in gradation and texture to the material that will be used for fill in the reinforced zone shall be established in accordance with GSI GRI GG5 or GSI GRI GT6.

## Calculations; GA-KC.

The Contractor shall submit a calculation of the long term design strength for the reinforcement in accordance with the NCMA or FHWA design method. The ultimate strength or index strength shall be based on the minimum average roll value tensile strength of the product using the wide width strength test in ASTM D 4595 or the single rib test in GSI GRI GG1. The calculation shall itemize each reduction factor and include backup data to justify each reduction factor.

The Contractor shall submit design calculations, including computer output data and program documentation. The calculations shall

include all items described under PARAGRAPH: SEGMENTAL RETAINING WALL DESIGN.

#### SD-04 Samples

Segmental Concrete Units; GA-RE

The Contractor shall submit two samples of each proposed block. Each sample shall be typical of the size, texture, color, and finish.

Reinforcement

The Contractor shall submit samples of each type of reinforcement. The samples shall be labeled and have a minimum size 200 by 250 mm. Geogrid shall include at least 2 apertures (3 junctions) in each direction.

#### SD-07 Certificates

Certificate of Compliance

The Contractor shall submit an affidavit certifying that the reinforcement meets the project specifications. The affidavit shall be signed by an official authorized to certify on behalf of the manufacturer and shall be accompanied by a mill certificate that verifies physical properties were tested during manufacturing and lists the manufacturer's quality control testing. If the affidavit is dated after award of the contract and/or is not specific to the project, the supplier shall attach a statement certifying that the affidavit addressed to the wholesale company is representative of the material supplied. The documents shall include a statement confirming that all purchased resin used to produce reinforcement is virgin resin. The mill certificate shall include the tensile strength tested in accordance with either ASTM D 4595 or GSI GRI GG1.

Qualifications

The Contractor shall provide documentation showing that the installer and supplier meet the qualifications listed.

### 1.4 SEGMENTAL RETAINING WALL DESIGN

The Contractor shall complete all stability analyses in accordance with either the NCMA SRW Manual, or the Federal Highway Administration/AASHTO method detailed in FHWA SA-96-071. Only one method shall be followed for the complete design, including reinforcement design strength, layout, stability calculations, and seismic effects. The segmental retaining wall system shall be designed under the direction of, and be signed by, a professional engineer. The engineer shall visit the job at least once during the construction.

#### 1.4.1 Design

Calculations shall include determination of long term design strength of

reinforcement specific to this project in accordance with the NCMA SRW Manual or FHWA SA-96-071. Calculations shall include analysis of all failure modes listed in the NCMA SRW Manual. Design calculations shall include a clear outline of material properties and assumptions. The Contractor shall use the following soil parameters and water elevation for stability analysis, and shall select additional soil parameters as required to complete the analysis.

Moist Unit Weight of reinforced fill, 18 kN/m<sup>3</sup>  
 Internal Friction Angle of reinforced fill, 30 degrees  
 Cohesion of reinforced fill, 0 kPa

#### 1.4.1.1 External Stability Design Requirements

As a minimum requirement, the length of the reinforcing at the base of the wall shall not be less than 0.7 times the total height of the blocks.

#### 1.4.1.2 Seismic Design Requirements

The Contractor shall complete the seismic stability analysis in accordance with NCMA Seismic Manual or FHWA SA-96-071. The pseudo-acceleration value with a 10 percent probability of exceedance in 50 years (referred to as the A value by NCMA and FHWA) shall be assumed as 0.15.

#### 1.4.1.3 Global Stability Design Requirements

The long term design strength of the lowest reinforcement layers shall equal or exceed the requirements listed in Table 1. Reinforcement lengths shall be no less than the lengths shown on the drawings.

#### 1.4.2 Layout

Shop drawings shall reflect all information needed to fabricate and erect the walls including the leveling pad elevations; the shape and dimensions of wall elements; the number, size, type, and details of the soil reinforcing system and anchorage; and identification of areas requiring coping. The design and layout of the internal reinforcement shall be subject to the following:

- a. All features indicated in the contract documents shall be incorporated in the final design and construction.
- b. The leveling pad elevations may vary, but shall be no higher than the embedment depth profile shown
- c. Each reinforcement level shall run as continuous as practical throughout the profile. If a geotextile filter is present, the reinforcement shall be laid out so that interference with the geotextile is minimized.
- d. Any reinforcement not placed with the machine direction as the design reinforcement direction shall be identified on the shop drawings.
- e. Reinforcement attached to the wall facing shall not combine geogrid

and geotextile, nor products from different manufacturers, within one wall. The number of reinforcement products shall be limited to avoid confusion in placement. For walls under 3.5 meters high, all reinforcement shall be the same grade and strength (i.e. design with one reinforcement strength).

#### 1.5 CONTRACTOR QUALIFICATIONS

The job foreman or the company directly responsible for the wall installation shall have completed a minimum of 10 segmental concrete retaining wall projects.

#### 1.6 SUPPLIER QUALIFICATIONS

Suppliers of segmental retaining wall system components shall have demonstrated experience in the supply of similar size and types of segmental retaining walls on previous projects.

#### 1.7 MANUFACTURER'S REPRESENTATIVE

The Contractor shall have a qualified and experienced representative from the block or reinforcement manufacturer available on an as-needed basis during the wall construction. The representative shall visit the site for consultation as requested by the Contracting Officer.

#### 1.8 DELIVERY, STORAGE AND HANDLING

The Contractor shall check products upon delivery to assure that the proper material has been received and is undamaged. For geosynthetics, the guidelines presented in ASTM D 4873 shall be followed.

##### 1.8.1 Segmental Concrete Units and Wall Caps

The Contractor shall protect blocks from damage and exposure to cement, paint, excessive mud, and like materials. The Contractor shall check materials upon delivery to assure that the block dimensions are within the tolerances specified.

##### 1.8.2 Geosynthetic Labeling

Each roll shall be labeled with the manufacturer's name, product identification, roll dimensions, lot number, and date manufactured.

##### 1.8.3 Geosynthetic Handling

Geosynthetic rolls shall be handled and unloaded by hand, or with load carrying straps, a fork lift with a stinger bar, or an axial bar assembly. Geosynthetic rolls shall not be dragged, lifted by one end, lifted by cables or chains, or dropped to the ground.

##### 1.8.4 Geosynthetic Storage

Geosynthetics shall be protected from cement, paint, excessive mud, chemicals, sparks and flames, temperatures in excess of 70 degrees C, and

any other environmental condition that may degrade the physical properties. If stored outdoors, the rolls shall be elevated from the ground surface. Geosynthetics, except for extruded grids, shall be protected with an opaque waterproof cover. Geosynthetics shall be delivered to the site in a dry and undamaged condition. Geotextiles shall not be exposed to direct sunlight for more than 7 days.

## PART 2 PRODUCTS

### 2.1 SEGMENTAL CONCRETE UNITS

#### 2.1.1 Architectural requirements

- a. Face color - Tan.
- b. Face Texture - split face typical of broken mortar/brick face.
- c. Face Appearance - straight, single-surface face/sculptured with 3-surface beveled face/rounded, smooth-curved face.
- d. Batter - Blocks shall be engaged to the block below by use of keys, lips, pins, clips, or other reliable mechanism to provide a consistent wall batter between 1H:6V and 1H:16V.
- e. Block Size - a minimum of 0.06 square meters of face area, and minimum 150 mm.
- f. Bond configuration - No bond configuration is required for straight face blocks. Beveled or sculptured face blocks shall be designed to stack with a half-bond (joints located at midpoint of vertically adjacent blocks). The block edges shall be finished so that vertical joints are flush.

#### 2.1.2 Structural Requirements

The blocks shall be manufactured to the requirements of ASTM C 1372, except for the following modifications:

- a. Minimum 28-day compressive strength of 31 MPa, based on net area in accordance with ASTM C 140.
- b. A maximum moisture absorption rate of 145 kg/m<sup>3</sup>, in accordance with ASTM C 140.
- c. The minimum oven dry density of concrete shall be 2000 kg/m<sup>3</sup>.
- d. The blocks shall provide a minimum of 400 kilograms per square meter of wall face area (determined without void filling).
- e. For freeze-thaw durability tested in accordance with ASTM C 1262, specimens shall comply with either of the following: (1) the weight loss of each of 5 specimens after 100 cycles shall not exceed 1 percent; or (2) the weight loss of each of 5 specimens after 150 cycles shall not

exceed 1.5 percent. when tested in a 3 percent saline solution: (1) the weight loss of each of 5 specimens after 40 cycles shall not exceed 1 percent; or (2) the weight loss of 4 out of 5 specimens after 50 cycles shall not exceed 1.5 percent.

### 2.1.3 Wall Caps

Segmental concrete block units shall be placed as caps on top of all segmental concrete retaining walls. The cap blocks shall have a color and texture on exposed faces to match that of the other blocks and meet the requirements for the other blocks except that the minimum height shall be 75 mm. Each cap block shall have abutting edges saw cut or formed to provide tight, flush abutting joints with no gaps in the joints when placed end to end in the alignment shown on the drawings.

## 2.2 REINFORCEMENT

### 2.2.1 Geogrid Reinforcement

Geogrid shall be a geosynthetic manufactured for reinforcement applications.

The geogrid shall be a regular network of integrally connected polymer tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil, aggregate, or other fill materials. The geogrid structure shall be dimensionally stable and able to retain its geometry under manufacture, transport and installation. The geogrid shall be manufactured with 100 percent virgin resin consisting of polyethylene, polypropylene, or polyester, and with a maximum of 5 percent in-plant regrind material. Polyester resin shall have a minimum molecular weight of 25,000 and a carboxyl end group number less than 30. Polyethylene and polypropylene shall be stabilized with long term antioxidants.

### 2.2.2 Geotextile Reinforcement

Geotextile shall be a pervious sheet of polymeric material and shall consist of long-chain synthetic polymers composed of at least 95 percent by weight polyethylene, polypropylene, or polyesters. The geotextile shall be manufactured with 100 percent virgin resin, and with a maximum of 5 percent in-plant regrind material. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the selvages. Polyester resin shall have a minimum molecular weight of 20,000 and a carboxyl end group number less than 50. Polyethylene and polypropylene shall be stabilized with long term antioxidants.

For survivability during installation, and in addition to installation damage used in calculating the long term design strength, the geotextile shall meet the minimum requirements in AASHTO M 288 Class 1, and shall have a minimum mass per unit area of 270 g/l. .

### 2.2.3 Reinforcement Properties

The reinforcement shown in the approved shop drawing submittal shall meet the long term design strength requirements used in the design, and shall

meet the properties listed in Table 1. Reinforcement strength requirements represent minimum average roll values in the machine direction. The reinforcement shown on the contract drawings shall meet the property requirements listed in Table 1. Reinforcement strength requirements represent minimum average roll values in the machine direction.

TABLE 1. REINFORCEMENT PROPERTIES

PROPERTY	REQUIREMENT	TEST DESIGNATION
Permittivity (geotextiles)	0.5 per second	ASTM D 4491
UV Resistance	70 percent after 500 hours	ASTM D 4355

#### 2.2.3.1 Long Term Design Strength

The long term design strength shall be based on reduction factors for installation damage and durability that are applicable to the fill that will be used. Minimum reduction factors for durability include: 1.1 for polyethylene and polypropylene geosynthetics, 1.15 for coated polyester geogrids, and 1.6 for polyester geotextiles. The creep reduction factor must be consistent with the test procedure used for determining the ultimate strength.

#### 2.3 GEOTEXTILE FILTER

Geotextiles used as filters shall meet the requirements specified in Table 2. The property values (except for AOS) represent minimum average roll values (MARV) in the weakest principal direction. For survivability during installation, the geotextile shall meet the minimum requirements in AASHTO M 288 Class 2, and shall have a minimum mass per unit area of 270 g/m<sup>2</sup>.

TABLE 2. GEOTEXTILE PHYSICAL PROPERTIES

PROPERTY	TEST REQUIREMENT	TEST METHOD
Grab Tensile, N	700 nonwoven 1100 woven	ASTM D 4632
Apparent Opening Size (µm)	150 - 212	ASTM D 4751
Permittivity, sec-1	0.5	ASTM D 4491

#### 2.4 SOILS AND AGGREGATES

All material placed as fill shall consist of material classified by ASTM D 2487 as GW, GP, GC, GM, SP, SM, SC, CL, ML, or SW. The material shall be free of ice; snow; frozen earth; trash; debris; sod; roots; organic matter; contamination from hazardous, toxic or radiological substances; or stones larger than 3 inches in any dimension. Each material shall be obtained entirely from one borrow source, unless the Contracting Officer determines



that quality control is adequate and the alternate source produces material that is similar in gradation, texture, and interaction with the reinforcement. The Contractor shall supply any testing required by the Contracting Officer to evaluate alternate sources. All materials shall be of a character and quality satisfactory for the purpose intended.

a. Drainage Aggregate shall meet the requirements of ASTM D 448, size No.7.

b. Aggregate Base material for the wall leveling pads shall meet the requirements of ASTM D 1241, gradation C.

c. Reinforced Fill. Soil placed in the reinforced fill zone shall consist of granular material with less than 515 percent passing the 75  $\mu$ m sieve.

c. Retained Fill. Soil placed in the retained fill zone shall meet the minimum requirements above.

## 2.5 MASONRY ADHESIVE

The masonry adhesive shall meet the following requirements:

- a. ASTM C 920, Type S, Grade NS, Class 25
- b. expected 30 year life
- c. meet the recommendations of the block manufacturer

## 2.6 DRAINAGE PIPE

The drainage pipe shall be corrugated polyethylene pipe meeting requirements of AASHTO M 252.

## PART 3 EXECUTION

### 3.1 CLASSIFICATION OF SOIL MATERIALS

Classification of soil materials shall be performed by the Contractor in accordance with ASTM D 2488. The Contracting Officer reserves the right to revise the Contractor classifications. In the case of disagreement, the Contracting Officer's classification will govern unless the soils are classified in accordance with ASTM D 2487. All testing completed by the Contractor in conjunction with soil material classification will be considered incidental to the contract work.

### 3.2 EARTHWORK

The leveling pad and reinforced fill zone shall bear on undisturbed native soils, or acceptably placed and compacted fill. In the event that it is necessary to remove material to a depth greater than specified or to place fill below the leveling pad not otherwise provided for in the contract, the Contracting Officer shall be notified prior to work and an adjustment in the contract price will be considered in accordance with the contract. Additional work not authorized by the Contracting Officer shall be at the Contractor's expense.

### 3.2.1 Excavation

Foundation soil shall be excavated as required for leveling pad dimensions and reinforcement placement shown on the construction drawings. Material for backfilling shall be stockpiled in a neat and orderly manner at a sufficient distance from the banks of the excavation to avoid overloading and to prevent slides or caving. Excavation and fill shall be performed in a manner and sequence that will provide proper drainage at all times. The Contractor is responsible for disposal of surplus material, waste material, and material that does not meet specifications, including any soil which is disturbed by the Contractor's operations or softened due to exposure to the elements and water.

### 3.2.2 Stockpiles

Stockpiles of all material to be incorporated into the work shall be kept in a neat and well drained condition, giving due consideration to drainage at all times. The ground surface at stockpile locations shall be cleared, grubbed, and sealed. Topsoil shall be stockpiled separately from suitable backfill material. Stockpiles of aggregates and granular soils shall be protected from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes frozen, saturated, intermixed with other materials, or otherwise out of specification or unsatisfactory for the use intended, such material shall be removed and replaced with new material from approved sources at no additional cost to the Government.

## 3.3 LEVELING PAD

### 3.3.1 Aggregate Base Leveling Pad

The subgrade below the leveling pad shall be compacted with at least 3 passes with a vibratory plate compactor with an operating weight not less than 200 kg. The aggregate base material shall be placed in lifts not exceeding 150 mm and compacted with at least 3 passes with a vibratory plate compactor. If the subgrade or aggregate base pumps, bleeds water, or cracks during compaction, the Contracting Officer shall be notified and, if no other changes are directed, the aggregate shall be replaced with a concrete leveling pad.

### 3.3.2 Concrete Leveling Pad

Tolerances in screeding shall be sufficient to place the blocks directly on the leveling pad without mortar, pointing, or leveling course between the blocks and leveling pad.

## 3.4 BLOCK INSTALLATION

The wall system components shall be constructed in accordance with the wall supplier's recommendations and construction manual. Damaged blocks shall not be incorporated in the retaining wall.

- a. Block placement shall begin at the lowest leveling pad elevation.

The blocks shall be in full contact with the leveling pad. Each course of block shall be placed sequentially for the entire wall alignment to maintain a level working platform for layout of reinforcement and placement of fill.

b. The grade and alignment of the first course shall be surveyed and the results furnished to the Contracting Officer prior to placing the second course. Survey control for alignment shall include a string line, offset from a base line, or suitable provisions that can be reproduced for quality assurance.

c. The blocks shall be placed with the edges in tight contact. No gap shall be allowed for wall batter and curvature. The vertical joints shall be maintained with a minimum 100 mm overlap on the underlying block. Coping required to keep block alignment shall be done with a full depth saw cut. No splitting shall be allowed.

d. Stacking of blocks prior to filling any lower course of block with drainage aggregate will not be allowed.

e. Cap units and the top two course of blocks shall be joined using masonry adhesive. Care shall be taken to keep adhesive from coming into contact with the face of wall units.

### 3.5 REINFORCEMENT INSTALLATION

a. Before placing reinforcement, the subgrade or subsequent lift of fill shall be compacted and graded level with the top of the blocks. The surface shall be smooth and free of windrows, sheepfoot impressions, and rocks.

b. Reinforcement shall be placed at the elevations and to the extent shown on the construction drawings and the approved shop drawing submittal. Reinforcement shall be oriented with the design strength axis perpendicular to the wall face. Each segment of reinforcement shall be continuous. Spliced connections between shorter pieces of reinforcement will not be allowed. Reinforcement strips shall be placed immediately next to adjacent strips to provide 100 percent coverage.

c. The reinforcement shall be installed in tension. The reinforcement shall be pulled taut and anchored with staples or stakes prior to placing the overlying lift of fill. The tension shall be uniform along the length of the wall and consistent between layers.

d. All reinforcement shall be 100% covered by soil so that reinforcement panels do not contact in overlaps. Where the wall bends, a veneer of fill shall be placed to a nominal thickness of 75 mm to separate overlapping reinforcement.

### 3.6 FILL PLACEMENT

a. Fill placement, including drainage aggregate, shall be completed to the top of each course of facing blocks prior to stacking the subsequent course of blocks

b. Reinforced fill shall be placed from the wall back toward the fill area to ensure that the reinforcement remains taut. Fill shall be placed, spread, and compacted in such manner that minimizes the development of wrinkles in or movement of the reinforcement.

c. A minimum fill thickness of 150 mm is required prior to operation of vehicles over the reinforcement. Sudden braking and sharp turning shall be avoided. Tracked equipment shall not turn within the reinforced fill zone to prevent tracks from displacing the fill and damaging the reinforcement. Construction equipment shall not be operated directly upon the reinforcement as part of the planned construction sequence. Rubber tired equipment may operate directly on the reinforcement if: the Contractor submits information documenting testing of equipment operating on a similar geogrid product on similar soils, the travel is infrequent, equipment travels slow, turning is minimized, and no damage or displacement to the reinforcement is observed.

d. Drainage aggregate shall be placed and tamped directly behind, between, and within the cells of the facing units. Compaction of the drainage aggregate shall be achieved by at least two passes on each lift with a vibratory plate compactor. Care shall be taken not to contact or chip the blocks with the compactor. Aggregate placed within the block cores and recesses shall be compacted by hand tamping and rodding.

e. At the end of each day, the Contractor shall slope the last lift of fill away from the wall in a manner that will allow drainage and direct runoff away from the wall face.

### 3.7 COMPACTION

Fill shall not be placed on surfaces that contain mud, frost, organic soils, fill soils that have not met compaction requirements, or where the Contracting Officer determines that unsatisfactory material remains in or under the fill. Fill shall be spread and compacted in lifts not exceeding the height of one course of blocks.

#### 3.7.1 Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 698. The maximum density is hereafter abbreviated as the "Standard Proctor" value.

#### 3.7.2 Moisture Control

Control of moisture in the fill shall be maintained to provide acceptable compaction. Disking and plowing will not be allowed in the reinforced fill zone. Moisture content of cohesive soils shall be adjusted at the borrow source before placement. Adding water directly to the reinforced fill zone shall only be conducted under conditions where the soil has sufficient porosity and capillarity to provide uniform moisture throughout the fill during compaction.

#### 3.7.3 Compaction

Reinforced and retained fill shall be compacted to 95 percent of the Standard Proctor Density. Care shall be exercised in the compaction process to avoid misalignment of the facing blocks. Heavy compaction equipment (including vibratory drum rollers) shall not be used within 900 mm from the wall face.

### 3.8 SOIL TESTING

#### 3.8.1 General

All testing expenses shall be the Contractor's responsibility. Prior to sampling and testing the work, testing laboratories shall be inspected and approved in accordance with Section 01451, CONTRACTOR QUALITY CONTROL. The Contracting Officer reserves the right to direct the location and select the material for samples to be tested and to direct where and when moisture-density tests shall be performed. Nuclear density testing equipment shall be used in general accordance with ASTM D 2922.

#### 3.8.2 Transmittal

The Contracting Officer shall be informed of test results daily for direction on corrective action required. Draft copies of field testing results shall be furnished to the Contracting Officer on a frequent and regular basis, as directed.

#### 3.8.3 Corrective Action.

Tests of materials which do not meet the contract requirements (failing test) will not be counted as part of the required testing. Each such failing test must be retaken at the same location as the failing test was taken. If testing indicates material does not meet the contract requirements, the material represented by the failing test shall not be placed in the contract work or shall be recompacted or removed. The quantity of material represented by the failing test shall be determined by the Contracting Officer up to the quantity represented by the testing frequency. The Contractor may increase testing frequency in the vicinity of a failing test in order to reduce removal requirements, as approved by the Contracting Officer. Such increases in testing frequency shall be at the Contractor's expense and at no additional cost to the Government.

#### 3.8.4 Testing Schedule

Moisture-Density Relations (ASTM D 698)

One test for each material variation, not less than \_\_\_\_ tests total.

In-Place Densities (ASTM D 1556 or ASTM D 2922)

Not less than 1 test for each 0.67 meters per 100 meters along wall face.

Sieve Analysis, (ASTM C 136)

- (1) Drainage Aggregate, 1 test for each source.

### 3.9 REINFORCEMENT TESTING

All testing expenses shall be the Contractor's responsibility. Testing shall be performed by a commercial testing laboratory selected by the Contractor and approved by the Contracting Officer or performed by the Contractor if approved by the Contracting Officer. The Contracting Officer reserves the right to direct the location and select the material for samples

TABLE 3. REINFORCEMENT TESTING

PROPERTY	TEST DESIGNATION	FREQUENCY
Wide Width Strip Tensile Strength or Single Rib Tensile Strength	ASTM D 4595  GSI GRI GG1	100 meters  100 meters

ASTM D 4595 shall be modified for geogrids considering recommendations in GSI GRI GG6; and the tensile strength shall be expressed on a unit length basis by substituting  $n \cdot a$  for  $W_s$ , where:

$W_s$  = specimen width, (mm)

$n$  = number of ribs in the sample (must be a whole number)

$a$  = nominal rib spacing for the product tested, (mm)

### 3.10 DRAINAGE PIPE

Drain pipe shall be placed as indicated on the drawings. Drain lines shall be laid to true grades and alignment with a continuous fall in the direction of flow. The interior of the pipe shall be kept clean from soil and debris; and open ends shall be temporarily capped as necessary.

### 3.11 CONSTRUCTION TOLERANCES

a. Horizontal: The top of wall shall be within 75 mm of the plan location.

b. Vertical: The top of wall elevations shall be within 30 mm above to 30 mm below the prescribed top of wall elevations shown on the drawings.

c. Plumbness and Alignment: The wall batter and alignment offset measured as deviation from a straight edge shall be within plus or minus 30 mm per 3 meter station. The batter measured from vertical shall be within 2 degrees of the plan dimension.

d. Block Defects: The blocks will be accepted on the basis of tolerances specified in ASTM C 1372.

e. Block Gaps: Gaps between adjacent blocks shall not exceed 3 mm.

## 3.12 PROTECTION OF WORK

Work shall be protected against damage from subsequent operations. Disturbed or displaced blocks shall be removed and replaced to conform to all requirements of this section. Damaged material shall not be incorporated into the wall. Upon completion of wall erection, the Contractor shall clean the wall face to remove any loose soil deposits or stains.

-- End of Section --

## SECTION 02833

## SYNTHETIC SPORTS SURFACE

04/01

## PART 1 GENERAL

The product shall be an impermeable, synthetic sports surface, designed for track and field activities. The system shall consist of a base mat, and of recycled rubber granules bound with a polyurethane binder and a impermeable layer of bi-component urethane coating, and a pigmented spray-applied top finish of polyurethane spray-coating and EPDM rubber granules. The system shall b installed on site.

## 1.1 REFERENCES

## AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM D 395	Standard Test Methods for Rubber Property-Compression Set
ASTM D 412	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension
ASTM D 501	Standard Test Methods of Sampling and Chemical Analysis of Alkaline Detergents
ASTM D 624	Tear Strength of Conventional Vulcanized Rubber Thermoplastic Elastomers
ASTM D 822	Standard Practice for Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Exposure Apparatus
ASTM D 1984	Standard Specification of Tall Oil Fatty Acids
ASTM D 2240	Standard Test Method for Rubber Property-Durometer Hardness
ASTM D 2632	Standard Test Method for Rubber Property-Resilience by Vertical Rebound

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete



system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-03 Product Data

Item Covered by Submittal; GA-BK, GA-CH, GA-DN, GA-HQ

The Contractor shall submit descriptive technical data on the primers, granules, impermeable layer, structural spray coating, and line marking paint.

#### SD-07 Certificates

GA-AO

The Contractor shall provide documentation showing that the installer and supplier meet the qualifications listed.

#### SD-08 Manufacturer's Instructions

The Contractor shall provide written instructions provided by the manufacturer of all the materials used in the construction of the synthetic running track.

### 1.3 WARRANTY

The product shall be warranted against defects in workmanship, labor, and materials for 60 months at no extra cost to the government.

## PART 2 PRODUCTS

### 2.1 PRIMER

Polyurethane-based primers shall be compatible with the base and track surfacing materials.

### 2.2 BLACK RECYCLED RUBBER GRANULES

The rubber granules for the base mat shall be recycled rubber, processed and chopped to 1 to 3 mm size, containing less than 4% dust.

### 2.3 POLYURETHANE BINDER

Binder for the black rubber mat shall be an MDI-based mono-component, polyurethane binding agent. The binding agent shall not have a free TDI monomer level above 0.2%, must be clear in color, not milky, and must be solvent free. The binding agent must be specially formulated for compatibility with SBR stranded or rubber crumb.

### 2.4 EPDM GRANULES

The rubber granules for the structural spray wearing coats shall be EPDM peroxide cured, man-made rubber containing a minimum 20% EPDM, with a specific gravity of 1.5 +/- 0.1, cryogenically processed and chopped to two different gradations, 0.5-1.5 mm and 1-3 mm. The EPDM rubber will be the same color as chosen by the owner for the track surface.

## 2.5 IMPERMEABLE LAYER

The resin for this application shall be a pigmented, thixotropic, two-component, polyol and isocyanate, moisture cured, urethane compound and shall be squeegee applied.

## 2.6 STRUCTURAL SPRAY COATING

The spray coating shall be a single component moisture cured, pigmented polyurethane, specifically formulated for compatibility with EPDM granules. The coating shall be the color red.

## 2.7 LINE MARKING PAINT

The line marking paint shall be polyurethane-based paint specifically manufactured to be compatible with polyurethane synthetic track surfaces.

# PART 3 EXECUTION

## 3.1 ASPHALTIC SURFACE INSPECTION

Prior to the application of the synthetic track surface, the asphaltic concrete base shall be inspected for conformity to planarity requirements. The surface shall not deviate from the specified grade more than 32 mm in 3 meters measured in any direction. All areas not in conformance with the above requirements will be repaired by others, with materials as approved by the manufacturer and allowed to cure prior to application of synthetic course. The surface shall be constructed with a slope of 60 mm per 3 meters towards the inner edge.

## 3.2 CURING

The asphalt surface shall be cured for a minimum of 14 days before construction of the synthetic surface begins.

## 3.3 CLEANING

The area to be surfaced shall be clean and free of any loose particle or foreign substances (dirt, oil, etc.) prior to commencement of the work.

## 3.4 PRIMING

The primer shall be spray-applied in accordance with the manufacturer's specifications. Primer shall be applied within 12 hours of synthetic material installation.

## 3.5 BASE MAT

### 3.5.1 Mixing

SBR granules and binder shall be mixed according to manufacturer's instructions. Mixing time shall be 2 to 4 minutes.

### 3.5.2 Application

The material shall be spread onto the asphalt mat using a mechanical tandem leveler. The tandem leveler shall have a heated oscillating screed bar for smoothness and compaction. The heated screed shall be heated to between 70 and 80 degrees C.

The laying procedure shall be bay-to-bay and limiting the length of the passes so as not to have any cold (or cured) lints between the bays. At the beginning of each work day, the traverse joint from the previous day shall be tack coated to ensure adequate bond. Small irregularities remaining in the surface after the tandem leveler has passed shall be removed using a length polyethylene or a Teflon roller.

### 3.6 IMPERMEABLE LAYER

The components are mixed at the prescribed ration homogeneously with suitable mixing device. This may be a strong drilling machine with a mixing paddle, a static mixing machine, or an automatic mixer. Mixing shall be done for 2 to 4 minutes per batch, depending on the mixer used. The coating shall be squeegee-applied to the base mat, making it impermeable.

### 3.7 STRUCTURAL SPRAY WEAR COATS

The top layer installation shall commence after the black rubber and sealer coat have cured. The top layer shall consist of a spray coating and EPDM granules. The base mat shall be dry, clean, and free of dust, oils, and greases. The spray coating material shall be mixed with the EPDM granules in a suitable device. Application of the mixture shall include the use of a structure-spray-machine. The mixture shall be placed using two applications in alternate directions with approximately 0.7 kg per square meter per coat.

### 3.8 LINE MARKINGS

All markings shall be applied by personnel with at least 2 years experience in similar projects utilizing polyurethane based paint compatible with the synthetic track surfacing. All markings dimensions shall be certified in accordance with the specifications issued by the appropriate sanctioning or governing body.

### 3.9 PYSICAL REQUIREMENTS

The completed surface shall meet the following requirements:

Thickness: 13 mmor as specified in the drawings

Shore A Hardness	ASTM D 2240	55 +/-5
Elongation at Break	ASTM D 412	110%

The completed surface shall meet the following requirements:

Tensile Strength	ASTM D 412	0.80 N/sq mm (at 20 degrees C)
Compression Set Recovery	ASTM D 395	90-95% over 24 hour period (at 20 degrees C)
Abrasion Resistance	ASTM D 501	0.25 grams loss after 100 cycles
Chalking	ASTM D 822	No change after 1000 hours
Coefficient of Friction	ASTM D 1984	Dry: 0.70 to 0.75 Wet: 0.60 to 0.65
Resilience	ASTM D 2632	38 to 42%
Tear Resistance	ASTM D 624	414-517 kPa (60-75psi)

### 3.10 CONTRACTOR QUALIFICATIONS

The contractor shall submit evidence of at least 20 surface installations in the last 3 years utilizing the type of system specified herein.

The surfacing contractor chosen shall show proof of manufacturing their own polyurethane coatings.

-- End of Section --

## SECTION 02921

SEEDING  
05/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act (1995) Federal Seed Act Regulations Part 201

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602 (1995a) Agricultural Liming Materials

ASTM D 977 (1998) Emulsified Asphalt

ASTM D 2028 (1976; R 1997) Cutback Asphalt (Rapid-Curing Type)

ASTM D 4972 (1995a) pH of Soils

ASTM D 5268 (1992; R 1996) Topsoil Used for Landscaping Purposes

ASTM D 5883 (1996el) Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purposes

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

SD-03 Product Data

Equipment; GA-SAB  
Surface Erosion Control Material  
Chemical Treatment Material

Manufacturer's literature including physical characteristics, application and installation instructions for equipment, surface erosion control material and chemical treatment material.

A listing of equipment to be used for the seeding operation.

Delivery

Delivery schedule.

Finished Grade and Topsoil

Finished grade status.

Topsoil

Availability of topsoil from the stripping and stock piling operation.

Quantity Check

Bag count or bulk weight measurements of material used compared with area covered to determine the application rate and quantity installed.

Seed Establishment Period; GA-SAB

Calendar time period for the seed establishment period. When there is more than one seed establishment period, the boundaries of the seeded area covered for each period shall be described.

Maintenance Record

Maintenance work performed, area repaired or reinstalled, diagnosis for unsatisfactory stand of grass plants.

Application of Pesticide

Pesticide treatment plan with sequence of treatment work with dates and times. The pesticide trade name, EPA registration number, chemical composition, formulation, concentration of original and diluted material, application rate of active ingredients, method of application, area treated, amount applied; and the name and state license number of the state certified applicator shall be included.

SD-04 Samples

Delivered Topsoil

Samples taken from several locations at the source.

Soil Amendments

A 4.5 kg sample.

Mulch

A 4.5 kg sample.

#### SD-06 Test Reports

Equipment Calibration

Certification of calibration tests conducted on the equipment used in the seeding operation.

Soil Test; GA-SAB

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

#### SD-07 Certificates

Seed; GA-SAB

Topsoil; GA-SAB

pH Adjuster; GA-SAB

Fertilizer; GA-SAB

Organic Material; GA-SAB

Soil Conditioner; GA-SAB

Mulch; GA-SAB

Asphalt Adhesive; GA-SAB

Pesticide; GA-SAB

Prior to the delivery of materials, certificates of compliance attesting that materials meet the specified requirements. Certified copies of the material certificates shall include the following:

- a. Seed. Classification, botanical name, common name, percent pure live seed, minimum percent germination and hard seed, maximum percent weed seed content, and date tested.
- b. Topsoil. Particle size, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.
- c. pH Adjuster. Calcium carbonate equivalent and sieve analysis.
- d. Fertilizer. Chemical analysis and composition percent.
- e. Organic Material: Composition and source.

- f. Soil Conditioner: Composition and source.
- g. Mulch: Composition and source.
- h. Asphalt Adhesive: Composition.
- i. Pesticide. EPA registration number and registered uses.

### 1.3 SOURCE INSPECTION

The source of delivered topsoil shall be subject to inspection.

### 1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

#### 1.4.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

##### 1.4.1.1 Delivered Topsoil

Prior to the delivery of any topsoil, its availability shall be verified in paragraph TOPSOIL. A soil test shall be provided for topsoil delivered to the site.

##### 1.4.1.2 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

##### 1.4.1.3 Pesticides

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the EPA registration number and the manufacturer's registered uses.

#### 1.4.2 Inspection

Seed shall be inspected upon arrival at the job site for conformity to species and quality. Seed that is wet, moldy, or bears a test date five months or older, shall be rejected. Other materials shall be inspected for compliance with specified requirements. The following shall be rejected: open soil amendment containers or wet soil amendments; topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 40 mm diameter; and topsoil that contains viable plants and plant parts. Unacceptable materials shall be removed from the job site.

#### 1.4.3 Storage

Materials shall be stored in designated areas. Seed, lime, and fertilizer shall be stored in cool, dry locations away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions



and not with seeding operation materials.

#### 1.4.4 Handling

Except for bulk deliveries, materials shall not be dropped or dumped from vehicles.

#### 1.4.5 Time Limitation

Hydroseeding time limitation for holding seed in the slurry shall be a maximum 24 hours.

### PART 2 PRODUCTS

#### 2.1 SEED

##### 2.1.1 Seed Classification

State-certified seed of the latest season's crop shall be provided in original sealed packages bearing the producer's guaranteed analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material. Labels shall be in conformance with AMS Seed Act and applicable state seed laws.

##### 2.1.2 Permanent Seed Species and Mixtures

Permanent seed species and mixtures shall be proportioned by weight as follows:

Botanical Name	Common Name	Mixture Percent by Weight	Percent Pure Live Seed
LAWN SEED			
Festuca arundinacea	Tall fescue	100	95%

##### 2.1.3 Quality

Weed seed shall be a maximum 1 percent by weight of the total mixture.

##### 2.1.4 Seed Mixing

The mixing of seed may be done by the seed supplier prior to delivery, or on site as directed.

##### 2.1.5 Substitutions

Substitutions will not be allowed without written request and approval from the Contracting Officer.

#### 2.2 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite in accordance with Section 02300 EARTHWORK. When additional topsoil is required beyond the available topsoil from the stripping operation, topsoil shall be delivered and amended as recommended by the soil test for the seed specified. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 40 mm diameter. Topsoil shall be free from viable plants and plant parts.

## 2.3 SOIL AMENDMENTS

Soil amendments shall consist of pH adjuster, fertilizer, organic material and soil conditioners meeting the following requirements. Vermiculite shall not be used.

### 2.3.1 pH Adjuster

The pH adjuster shall be an agricultural liming material in accordance with ASTM C 602. These materials may be burnt lime, hydrated lime, ground limestone, sulfur, or shells. The pH adjuster shall be used to create a favorable soil pH for the plant material specified.

#### 2.3.1.1 Limestone

Limestone material shall contain a minimum calcium carbonate equivalent of 80 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm sieve and a minimum 55 percent shall pass through a 0.250 mm sieve. To raise soil pH, ground limestone shall be used.

#### 2.3.1.2 Hydrated Lime

Hydrated lime shall contain a minimum calcium carbonate equivalent of 110 percent. Gradation: A minimum 100 percent shall pass through a 2.36 mm sieve and a minimum 97 percent shall pass through a 0.250 mm sieve.

#### 2.3.1.3 Burnt Lime

Burnt lime shall contain a minimum calcium carbonate equivalent of 140 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm sieve and a minimum 35 percent shall pass through a 0.250 mm sieve.

### 2.3.2 Fertilizer

It shall be as recommended by the soil test. Fertilizer shall be controlled release commercial grade, free flowing, uniform in composition, and consist of a nitrogen-phosphorus-potassium ratio. The fertilizer shall be derived from sulphur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea (IBDU). Fertilizer shall be balanced with the inclusion of trace minerals and micro-nutrients.

#### 2.3.3 Nitrogen Carrier Fertilizer

It shall be as recommended by the soil test. Nitrogen carrier fertilizer shall be commercial grade, free flowing, and uniform in composition. The

fertilizer may be a liquid nitrogen solution.

#### 2.3.4 Organic Material

Organic material shall consist of either rotted manure, decomposed wood derivatives, recycled compost, or worm castings.

##### 2.3.4.1 Rotted Manure

Rotted manure shall be unleached horse, chicken or cattle manure containing a maximum 25 percent by volume of straw, sawdust, or other bedding materials. It shall contain no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds and be free of stones, sticks, and soil.

##### 2.3.4.2 Decomposed Wood Derivatives

Decomposed wood derivatives shall be ground bark, sawdust, yard trimmings, or other wood waste material that is free of stones, sticks, soil, and toxic substances harmful to plants, and is fully composted or stabilized with nitrogen.

##### 2.3.4.3 Recycled Compost

Compost shall be a well decomposed, stable, weed free organic matter source. Compost shall be derived from food; agricultural or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. The compost shall possess no objectionable odors and shall not resemble the raw material from which it was derived. The material shall not contain substances toxic to plants. Gradation: The compost material shall pass through a 10 mm screen, possess a pH of 5.5 to 8.0, and have a moisture content between 35-55 percent by weight. The material shall not contain more than 1 percent by weight of man-made foreign matter. Compost shall be cleaned of plastic materials larger than 50 mm in length. Compost shall conform to EPA requirements in accordance with Section 01670 RECYCLED / RECOVERED MATERIALS.

##### 2.3.4.4 Worm Castings

Worm castings shall be screened from worms and food source, and shall be commercially packaged.

#### 2.3.5 Soil Conditioner

Soil conditioner shall be sand, super absorbent polymers, or gypsum for use singly or in combination to meet the requirements of the soil test.

##### 2.3.5.1 Sand

Sand shall be clean and free of toxic materials. Gradation: A minimum 95 percent by weight shall pass a 2 mm sieve and a minimum 10 percent by weight shall pass a 1.18 mm sieve. Greensand shall be balanced with the inclusion of trace minerals and nutrients.

#### 2.3.5.2 Super Absorbent Polymers

To improve water retention in soils, super absorbent polymers shall be sized and applied according to the manufacturer's recommendations. Polymers shall be added as a soil amendment and be cross-linked polyacrylamide, with an absorption capacity of 250-400 times its weight.

#### 2.3.5.3 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum 95 percent calcium sulfate by volume.

### 2.4 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region.

#### 2.4.1 Straw

Straw shall be stalks from oats, wheat, rye, barley, or rice, furnished in air-dry condition and with a consistency for placing with commercial mulch-blowing equipment.

#### 2.4.2 Hay

Hay shall be native hay, sudan-grass hay, broomsedge hay, or other herbaceous mowings, furnished in an air-dry condition suitable for placing with commercial mulch-blowing equipment.

### 2.5 ASPHALT ADHESIVE

Asphalt adhesive shall conform to the following: Emulsified asphalt, conforming to ASTM D 977, Grade SS-1; and cutback asphalt, conforming to ASTM D 2028, Designation RC-70.

### 2.6 WATER

Water shall be the responsibility of the Contractor, unless otherwise noted. Water shall not contain elements toxic to plant life.

### 2.7 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification, a soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

### 2.8 SURFACE EROSION CONTROL MATERIAL

Surface erosion control material shall conform to the following:

#### 2.8.1 Surface Erosion Control Blanket

Blanket shall be machine produced mat of wood excelsior formed from a web of

interlocking wood fibers; covered on one side with either knitted straw blanket-like mat construction; covered with biodegradable plastic mesh; or interwoven biodegradable thread, plastic netting, or twisted kraft paper cord netting.

#### 2.8.2 Surface Erosion Control Fabric

Fabric shall be knitted construction of polypropylene yarn with uniform mesh openings 19 to 25 mm square with strips of biodegradable paper. Filler paper strips shall have a minimum life of 6 months.

#### 2.8.3 Surface Erosion Control Net

Net shall be heavy, twisted jute mesh, weighing approximately 605 grams per meter and 1200 mm wide with mesh openings of approximately 25 mm square.

#### 2.8.4 Surface Erosion Control Chemicals

Chemicals shall be high-polymer synthetic resin or cold-water emulsion of selected petroleum resins.

#### 2.8.5 Hydrophilic Colloids

Hydrophilic colloids shall be physiologically harmless to plant and animal life without phytotoxic agents. Colloids shall be naturally occurring, silicate powder based, and shall form a water insoluble membrane after curing. Colloids shall resist mold growth.

#### 2.8.6 Erosion Control Material Anchors

Erosion control anchors shall be as recommended by the manufacturer.

### PART 3 EXECUTION

#### 3.1 INSTALLING SEED TIME AND CONDITIONS

##### 3.1.1 Seeding Time

Seed shall be installed from April 15th to June 1st for spring establishment; and from August 15th to September 30th for fall establishment.

##### 3.1.2 Seeding Conditions

Seeding operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the seeding operations, proposed alternate times shall be submitted for approval.

##### 3.1.3 Equipment Calibration

Immediately prior to the commencement of seeding operations, calibration tests shall be conducted on the equipment to be used. These tests shall confirm that the equipment is operating within the manufacturer's

specifications and will meet the specified criteria. The equipment shall be calibrated a minimum of once every day during the operation. The calibration test results shall be provided within 1 week of testing.

#### 3.1.4 Soil Test

Delivered topsoil, existing soil in smooth graded areas, and stockpiled topsoil shall be tested in accordance with ASTM D 5268 and ASTM D 4972 for determining the particle size, pH, organic matter content, textural class, chemical analysis, soluble salts analysis, and mechanical analysis. Sample collection on site shall be random over the entire site. Sample collection for stockpiled topsoil shall be at different levels in the stockpile. The soil shall be free from debris, noxious weeds, toxic substances, or other materials harmful to plant growth. The test shall determine the quantities and type of soil amendments required to meet local growing conditions for the seed species specified.

### 3.2 SITE PREPARATION

#### 3.2.1 Finished Grade and Topsoil

The Contractor shall verify that finished grades are as indicated on drawings, and the placing of topsoil, smooth grading, and compaction requirements have been completed in accordance with Section 02300 EARTHWORK, prior to the commencement of the seeding operation.

#### 3.2.2 Application of Soil Amendments

##### 3.2.2.1 Applying pH Adjuster

The pH adjuster shall be applied as recommended by the soil test. The pH adjuster shall be incorporated into the soil to a maximum 100 mm depth or may be incorporated as part of the tillage operation.

##### 3.2.2.2 Applying Fertilizer

The fertilizer shall be applied as recommended by the soil test. Fertilizer shall be incorporated into the soil to a maximum 100 mm depth or may be incorporated as part of the tillage or hydroseeding operation.

##### 3.2.2.3 Applying Soil Conditioner

The soil conditioner shall be as recommended by the soil test. The soil conditioner shall be spread uniformly over the soil a minimum 25 mm depth and thoroughly incorporated by tillage into the soil to a maximum 100 mm depth.

##### 3.2.2.4 Applying Super Absorbent Polymers

Polymers shall be spread uniformly over the soil as recommended by the manufacturer and thoroughly incorporated by tillage into the soil to a maximum 100 mm depth.

#### 3.2.3 Tillage

Soil on slopes up to a maximum 3-horizontal-to-1-vertical shall be tilled to a minimum 100 mm depth. On slopes between 3-horizontal-to-1-vertical and 1-horizontal-to-1 vertical, the soil shall be tilled to a minimum 50 mm depth by scarifying with heavy rakes, or other method. Rototillers shall be used where soil conditions and length of slope permit. On slopes 1-horizontal-to-1 vertical and steeper, no tillage is required. Drainage patterns shall be maintained as indicated on drawings. Areas compacted by construction operations shall be completely pulverized by tillage. Soil used for repair of surface erosion or grade deficiencies shall conform to topsoil requirements. The pH adjuster, fertilizer, and soil conditioner may be applied during this procedure.

#### 3.2.4 Prepared Surface

##### 3.2.4.1 Preparation

The prepared surface shall be a maximum 25 mm below the adjoining grade of any surfaced area. New surfaces shall be blended to existing areas. The prepared surface shall be completed with a light raking to remove debris.

##### 3.2.4.2 Lawn Area Debris

Debris and stones over a minimum 16 mm in any dimension shall be removed from the surface.

##### 3.2.4.3 Protection

Areas with the prepared surface shall be protected from compaction or damage by vehicular or pedestrian traffic and surface erosion.

#### 3.3 INSTALLATION

Prior to installing seed, any previously prepared surface compacted or damaged shall be reworked to meet the requirements of paragraph SITE PREPARATION. Seeding operations shall not take place when the wind velocity will prevent uniform seed distribution.

##### 3.3.1 Installing Seed

Seeding method shall be Broadcast Seeding. Seeding procedure shall ensure even coverage. Gravity feed applicators, which drop seed directly from a hopper onto the prepared soil, shall not be used because of the difficulty in achieving even coverage, unless otherwise approved. Absorbent polymer powder shall be mixed with the dry seed at the rate recommended by the manufacturer.

##### 3.3.1.1 Broadcast Seeding

Seed shall be uniformly broadcast at the rate of 7 kilograms per 93 square meters using broadcast seeders. Half the total rate of seed application shall be broadcast in 1 direction, with the remainder of the seed rate broadcast at 90 degrees from the first direction. Seed shall be covered a maximum 6 mm depth by disk harrow, steel mat drag, cultipacker, or other

approved device.

#### 3.3.1.2 Rolling

The entire area shall be firmed with a roller not exceeding 130 kilograms per meter roller width. Slopes over a maximum 3-horizontal-to-1 vertical shall not be rolled.

#### 3.3.2 Mulching

##### 3.3.2.1 Hay or Straw Mulch

Hay or straw mulch shall be spread uniformly at the rate of 0.75 metric tons per hectare. Mulch shall be spread by hand, blower-type mulch spreader, or other approved method. Mulching shall be started on the windward side of relatively flat areas or on the upper part of steep slopes, and continued uniformly until the area is covered. The mulch shall not be bunched or clumped. Sunlight shall not be completely excluded from penetrating to the ground surface. All areas installed with seed shall be mulched on the same day as the seeding. Mulch shall be anchored immediately following spreading.

##### 3.3.2.2 Mechanical Anchor

Mechanical anchor shall be a V-type-wheel land packer; a scalloped-disk land packer designed to force mulch into the soil surface; or other suitable equipment.

##### 3.3.2.3 Asphalt Adhesive Tackifier

Asphalt adhesive tackifier shall be sprayed at a rate between 666 to 866 liters per hectare. Sunlight shall not be completely excluded from penetrating to the ground surface.

##### 3.3.2.4 Non-Asphaltic Tackifier

Hydrophilic colloid shall be applied at the rate recommended by the manufacturer, using hydraulic equipment suitable for thoroughly mixing with water. A uniform mixture shall be applied over the area.

##### 3.3.2.5 Asphalt Adhesive Coated Mulch

Hay or straw mulch may be spread simultaneously with asphalt adhesive applied at a rate between 666 to 866 liters per hectare, using power mulch equipment which shall be equipped with suitable asphalt pump and nozzle. The adhesive-coated mulch shall be applied evenly over the surface. Sunlight shall not be completely excluded from penetrating to the ground surface.

#### 3.3.3 Watering Seed

Watering shall be started immediately after completing the seeding of an area. Water shall be applied to supplement rainfall at a rate sufficient to ensure moist soil conditions to a minimum 25 mm depth. Run-off and puddling shall be prevented. Watering trucks shall not be driven over turf areas,



unless otherwise directed. Watering of other adjacent areas or plant material shall be prevented.

### 3.4 SURFACE EROSION CONTROL

#### 3.4.1 Surface Erosion Control Material

Where indicated or as directed, surface erosion control material shall be installed in accordance with manufacturer's instructions. Placement of the material shall be accomplished without damage to installed material or without deviation to finished grade.

### 3.5 QUANTITY CHECK

For materials provided in bags, the empty bags shall be retained for recording the amount used. For materials provided in bulk, the weight certificates shall be retained as a record of the amount used. The amount of material used shall be compared with the total area covered to determine the rate of application used. Differences between the quantity applied and the quantity specified shall be adjusted as directed.

### 3.6 APPLICATION OF PESTICIDE

When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted and coordinated with the installation pest management program.

#### 3.6.1 Technical Representative

The certified installation pest management coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for pest or disease control. They may be present during treatment application.

#### 3.6.2 Application

A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. A closed system is recommended as it prevents the pesticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying pesticide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately. A pesticide plan shall be submitted.

### 3.7 RESTORATION AND CLEAN UP

#### 3.7.1 Restoration

Existing turf areas, pavements, and facilities that have been damaged from the seeding operation shall be restored to original condition at

Contractor's expense.

### 3.7.2 Clean Up

Excess and waste material shall be removed from the seeded areas and shall be disposed offsite. Adjacent paved areas shall be cleaned.

### 3.8 PROTECTION OF INSTALLED AREAS

Immediately upon completion of the seeding operation in an area, the area shall be protected against traffic or other use by erecting barricades and providing signage as required, or as directed.

### 3.9 SEED ESTABLISHMENT PERIOD

#### 3.9.1 Commencement

The seed establishment period to obtain a healthy stand of grass plants shall begin on the first day of work under this contract and shall end 3 months after the last day of the seeding operation. Written calendar time period shall be furnished for the seed establishment period. When there is more than 1 seed establishment period, the boundaries of the seeded area covered for each period shall be described. The seed establishment period shall be coordinated with Section 02930 EXTERIOR PLANTING. The seed establishment period shall be modified for inclement weather, shut down periods, or for separate completion dates of areas.

#### 3.9.2 Satisfactory Stand of Grass Plants

Grass plants shall be evaluated for species and health when the grass plants are a minimum 25 mm high.

##### 3.9.2.1 Lawn Area

A satisfactory stand of grass plants from the seeding operation for a lawn area shall be a minimum 200 grass plants per square meter. Bare spots shall be a maximum 150 mm square. The total bare spots shall be a maximum 2 percent of the total seeded area.

#### 3.9.3 Maintenance During Establishment Period

Maintenance of the seeded areas shall include eradicating weeds, insects and diseases; protecting embankments and ditches from surface erosion; maintaining erosion control materials and mulch; protecting installed areas from traffic; mowing; watering; and post-fertilization.

##### 3.9.3.1 Mowing

- a. Lawn Areas: Lawn areas shall be mowed to a minimum 75 mm height when the turf is a maximum 100 mm high. Clippings shall be removed when the amount cut prevents sunlight from reaching the ground surface.

##### 3.9.3.2 Post-Fertilization

The fertilizer shall be applied as recommended by the soil test. A maximum 4 kilograms per hectare of actual available nitrogen shall be provided to the grass plants. The application shall be timed prior to the advent of winter dormancy and shall be made without burning the installed grass plants.

#### 3.9.3.3 Pesticide Treatment

Treatment for disease or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE.

#### 3.9.3.4 Repair or Reinstall

Unsatisfactory stand of grass plants and mulch shall be repaired or reinstalled, and eroded areas shall be repaired in accordance with paragraph SITE PREPARATION.

#### 3.9.3.5 Maintenance Record

A record of each site visit shall be furnished, describing the maintenance work performed; areas repaired or reinstalled; and diagnosis for unsatisfactory stand of grass plants.

-- End of Section --

## SECTION 02930

## EXTERIOR PLANTING

06/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN NURSERY AND LANDSCAPE ASSOCIATION (ANLA)

ANLA ANSI/ANLA Z60.1 (1996) Nursery Stock

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A300 (1995) Tree Care Operations - Trees, Shrubs and other Woody Plant Maintenance

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 602 (1995a) Agricultural Liming Materials

ASTM D 4972 (1995a) pH of Soils

ASTM D 5034 (1995) Breaking Strength and Elongation of Textile Fabrics (Grab Test)

ASTM D 5035 (1995) Breaking Strength and Elongation of Textile Fabrics (Grab Test)

ASTM D 5268 (1992; R1996) Topsoil Used for Landscaping Purposes

ASTM D 5883 (1996) Standard Guide for Use of Rotary Kiln Produced Expanded Shale, Clay or Slate (ESCS) as a Mineral Amendment in Topsoil Used for Landscaping and Related Purposes

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless

otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

SD-02 Shop Drawings

Shop Drawings; GA-AO.

Scale drawings defining areas to receive plant materials.

SD-03 Product Data

Chemical Treatment Material

Manufacturer's literature including physical characteristics, application and installation instructions for chemical treatment material.

SD-04 Samples

Delivered Topsoil

Samples taken from several locations at the source.

Soil Amendments

A 4.5 kilogram sample.

Mulch

A 4.5 kilogram sample.

Geotextile

A 150 mm square sample.

Plant Establishment Period; GA-AO.

SD-06 Test Reports

Soil Test; GA-AO. Percolation Test

Certified reports of inspections and laboratory tests, prepared by an independent testing agency, including analysis and interpretation of test results. Each report shall be properly identified. Test methods used and compliance with recognized test standards shall be described.

SD-07 Certificates

Plant Material; GA-AO. Topsoil; GA-AO. pH Adjuster; GA-AO. Fertilizer; GA-AO. Organic Material; GA-AO. Soil Conditioner; GA-AO. Organic Mulch; GA-AO. Pesticide; GA-AO.

Prior to delivery of materials, certificates of compliance attesting that

materials meet the specified requirements. Certified copies of the material certificates shall include the following.

- a. Plant Material: Classification, botanical name, common name, size, quantity by species, and location where grown.
- b. Topsoil: Particle size, pH, organic matter content, textural class, soluble salts, chemical and mechanical analyses.
- c. pH Adjuster: Sieve analysis and calcium carbonate equivalent.
- d. Fertilizer: Chemical analysis and composition percent.
- e. Organic Material: Composition and source.
- f. Soil Conditioner: Composition and source.
- g. Organic Mulch: Composition, source, and treatment against fungi growth.
- h. Mycorrhizal Fungi Inoculum: Plant material treated.
- i. Pesticide. EPA registration number and registered uses.

#### SD-10 Operation and Maintenance Data

Maintenance Instructions; GA-AO.

Instruction for year-round care of installed plant material.

### 1.3 SOURCE INSPECTIONS

The nursery or source of plant material and the source of delivered topsoil shall be subject to inspection.

### 1.4 DELIVERY, INSPECTION, STORAGE, AND HANDLING

#### 1.4.1 Delivery

A delivery schedule shall be provided at least 10 calendar days prior to the first day of delivery.

##### 1.4.1.1 Plant Material Identification

Plant material shall be identified with attached, durable, waterproof labels and weather-resistant ink, stating the correct botanical plant name and size.

##### 1.4.1.2 Protection During Delivery

Plant material shall be protected during delivery to prevent desiccation and damage to the branches, trunk, root system, or earth ball. Branches shall be protected by tying-in. Exposed branches shall be covered during transport.

#### 1.4.1.3 Delivered Topsoil

Prior to the delivery of any topsoil, the availability of topsoil shall be verified in paragraph TOPSOIL. A soil test shall be provided for delivered topsoil.

#### 1.4.1.4 Soil Amendments

Soil amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's chemical analysis. In lieu of containers, soil amendments may be furnished in bulk. A chemical analysis shall be provided for bulk deliveries.

#### 1.4.1.5 Pesticide Material

Pesticide material shall be delivered to the site in the original, unopened containers bearing legible labels indicating the Environmental Protection Agency (EPA) registration number and the manufacturer's registered uses.

#### 1.4.2 Inspection

Plant material shall be well shaped, vigorous and healthy with a healthy, well branched root system, free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement or abrasion. Plant material shall be checked for unauthorized substitution and to establish nursery grown status.

Plant material showing desiccation, abrasion, sun-scald injury, disfigurement, or unauthorized substitution shall be rejected. The plant material shall exhibit typical form of branch to height ratio; and meet the caliper and height measurements specified. Plant material that measures less than specified, or has been poled, topped off or headed back, shall be rejected. Container-grown plant material shall show new fibrous roots and the root mass shall contain its shape when removed from the container. Plant material with broken or cracked balls; or broken containers shall be rejected. Bare-root plant material that is not dormant or is showing roots were pulled from the ground shall be rejected. Other materials shall be inspected for compliance with paragraph PRODUCTS. Open soil amendment containers or wet soil amendments shall be rejected. Topsoil that contains slag, cinders, stones, lumps of soil, sticks, roots, trash or other material larger than 40 mm diameter shall be rejected. Topsoil that contains viable plant material and plant parts shall be rejected. Unacceptable material shall be removed from the job site.

#### 1.4.3 Storage

##### 1.4.3.1 Plant Material Storage

Plant material not installed on the day of arrival at the site shall be stored and protected in designated areas. Plant material shall not be stored longer than 30 days. Plant material shall be protected from direct exposure to wind and sun. Bare-root plant material shall be heeled-in. All plant material shall be kept in a moist condition by watering with a fine mist spray until installed.

##### 1.4.3.2 Other Material Storage

Storage of other material shall be in designated areas. Soil amendments shall be stored in dry locations and away from contaminants. Chemical treatment material shall be stored according to manufacturer's instructions and not with planting operation material.

#### 1.4.4 Handling

Plant material shall not be injured in handling. Cracking or breaking the earth ball of balled and burlapped plant material shall be avoided. Plant material shall not be handled by the trunk or stems. Materials shall not be dropped from vehicles.

#### 1.4.5 Time Limitation

Except for container-grown plant material, the time limitation from digging to installing plant material shall be a maximum 90 days. The time limitation between installing the plant material and placing the mulch shall be a maximum 24 hours.

### 1.5 WARRANTY

Furnished plant material shall have a warranty for plant growth to be in a vigorous growing condition for a minimum 12 month period. A minimum 12 month calendar time period for the warranty of plant growth shall be provided regardless of the contract time period. When plant material is determined to be unhealthy in accordance with paragraph PLANT ESTABLISHMENT PERIOD, it shall be replaced once under this warranty.

## PART 2 PRODUCTS

### 2.1 PLANT MATERIAL

#### 2.1.1 Plant Material Classification

The plant material shall be nursery grown stock conforming to ANLA ANSI/ANLA Z60.1 and shall be the species specified.

#### 2.1.2 Plant Schedule

The plant schedule shall provide botanical names as included in one or more of the publications listed under "Nomenclature" in ANLA ANSI/ANLA Z60.1.

#### 2.1.3 Substitutions

Substitutions will not be permitted without written request and approval from the Contracting Officer.

#### 2.1.4 Quality

Well shaped, well grown, vigorous plant material having healthy and well branched root systems in accordance with ANLA ANSI/ANLA Z60.1 shall be provided. Plant material shall be provided free from disease, harmful insects and insect eggs, sun-scald injury, disfigurement and abrasion.



Plant material shall be free of shock or damage to branches, trunk, or root systems, which may occur from the digging and preparation for shipment, method of shipment, or shipment. Plant quality is determined by the growing conditions; method of shipment to maintain health of the root system; and growth of the trunk and crown as follows.

#### 2.1.5 Growing Conditions

Plant material shall be native to or well-suited to the growing conditions of the project site. Plant material shall be grown under climatic conditions similar to those at the project site.

#### 2.1.6 Method of Shipment to Maintain Health of Root System

##### 2.1.6.1 Balled and Burlapped (BB) Plant Material

Ball size and ratio shall be in accordance with ANLA ANSI/ANLA Z60.1. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. The plant stem or trunk shall be centered in the ball. All roots shall be clean cut at the ball surface. Roots shall not be pulled from the ground. Before shipment the root ball shall be dipped in gels containing mycorrhizal fungi inoculum. The root ball shall be completely wrapped with burlap or other suitable material and securely laced with biodegradable twine.

##### 2.1.6.2 Balled and Potted (Pot) Plant Material

Ball size and ratio shall be in accordance with ANLA ANSI/ANLA Z60.1. The ball shall be of a diameter and depth to encompass enough fibrous and feeding root system necessary for the full recovery of the plant. Removal shall be done by hand digging or mechanical devices. The plant stem or trunk shall be centered in the ball. All roots shall be clean cut at the ball surface. Roots shall not be pulled from the ground. Before shipment the root ball shall be dipped in gels containing mycorrhizal fungi inoculum. Container shall be used to retain the ball unbroken. Container shall be rigid to hold ball shape and protect root mass during shipping.

##### 2.1.6.3 Balled and Platform (BP) Plant Material

Ball size and ratio shall be in accordance with ANLA ANSI/ANLA Z60.1. Plants shall be prepared as balled and burlapped plant material and securely fastened to wood platform for shipping.

##### 2.1.6.4 Bare-Root (BR) Plant Material

Minimum root spread shall be in accordance with ANLA ANSI/ANLA Z60.1. A well branched root system characteristic of the species specified shall be provided. Roots shall not be pulled from the ground. Bare-root plant material shall be inoculated with mycorrhizal fungi during germination in the nursery. Before shipment the root system shall be dipped in gels containing mycorrhizal fungi inoculum. Bare-root plant material shall be dormant. The root system shall be protected from drying out.

##### 2.1.6.5 Container-Grown (C) Plant Material

Container size shall be in accordance with ANLA ANSI/ANLA Z60.1. Plant material shall be grown in a container over a duration of time for new fibrous roots to have developed and for the root mass to retain its shape and hold together when removed from the container. Container-grown plant material shall be inoculated with mycorrhizal fungi during germination in the nursery. Before shipment the root system shall be dipped in gels containing mycorrhizal fungi inoculum. The container shall be sufficiently rigid to hold ball shape and protect root mass during shipping.

#### 2.1.7 Growth of Trunk and Crown

##### 2.1.7.1 Deciduous Trees

A height to caliper relationship shall be provided in accordance with ANLA ANSI/ANLA Z60.1. Height of branching shall bear a relationship to the size and species of tree specified and with the crown in good balance with the trunk. The trees shall not be "poled" or the leader removed.

- a. Single stem: The trunk shall be reasonably straight and symmetrical with crown and have a persistent main leader.
- b. Multi-stem: All countable stems, in aggregate, shall average the size specified. To be considered a stem, there shall be no division of the trunk which branches more than 150 mm from ground level.
- c. Specimen: The tree provided shall be well branched and pruned naturally according to the species. The form of growth desired, which may not be in accordance with natural growth habit, shall be as indicated.

##### 2.1.7.2 Deciduous Shrubs

Deciduous shrubs shall have the height and number of primary stems recommended by ANLA ANSI/ANLA Z60.1. Acceptable plant material shall be well shaped, with sufficient well-spaced side branches, and recognized by the trade as typical for the species grown in the region of the project.

##### 2.1.7.3 Coniferous Evergreen Plant Material

Coniferous Evergreen plant material shall have the height-to-spread ratio recommended by ANLA ANSI/ANLA Z60.1. The coniferous evergreen trees shall not be "poled" or the leader removed. Acceptable plant material shall be exceptionally heavy, well shaped and trimmed to form a symmetrical and tightly knit plant. The form of growth desired shall be as indicated.

##### 2.1.7.4 Broadleaf Evergreen Plant Material

Broadleaf evergreen plant material shall have the height-to-spread ratio recommended by ANLA ANSI/ANLA Z60.1. Acceptable plant material shall be well shaped and recognized by the trade as typical for the variety grown in the region of the project.

##### 2.1.7.5 Ground Cover and Vine Plant Material

Ground cover and vine plant material shall have the minimum number of runners and length of runner recommended by ANLA ANSI/ANLA Z60.1. Plant material shall have heavy, well developed and balanced crown with vigorous, well developed root system and shall be furnished in containers.

#### 2.1.8 Plant Material Size

Plant material shall be furnished in sizes indicated. Plant material larger in size than specified may be provided at no additional cost to the Government.

#### 2.1.9 Plant Material Measurement

Plant material measurements shall be in accordance with ANLA ANSI/ANLA Z60.1.

### 2.2 TOPSOIL

Topsoil shall be as defined in ASTM D 5268. When available, the topsoil shall be the existing surface soil stripped and stockpiled onsite in accordance with Section 02300 EARTHWORK. When additional topsoil is required beyond the available topsoil from the stripping operation, topsoil shall be delivered and amended as recommended by the soil test for the plant material specified. Topsoil shall be free from slag, cinders, stones, lumps of soil, sticks, roots, trash or other material over a minimum 40 mm diameter. Topsoil shall be free from viable plants and plant parts.

### 2.3 SOIL AMENDMENTS

Soil amendments shall consist of pH adjuster, fertilizer, organic material and soil conditioners meeting the following requirements. Vermiculite is not recommended.

#### 2.3.1 pH Adjuster

The pH adjuster shall be an agricultural liming material in accordance with ASTM C 602. These materials may be burnt lime, hydrated lime, ground limestone, or shells. The pH adjuster shall be used to create a favorable soil pH for the plant material specified.

##### 2.3.1.1 Limestone

Limestone material shall contain a minimum calcium carbonate equivalent of 80 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm sieve and a minimum 55 percent shall pass through a 0.25 mm sieve. To raise soil pH, ground limestone shall be used.

##### 2.3.1.2 Hydrated Lime

Hydrated lime shall contain a minimum calcium carbonate equivalent of 110 percent. Gradation: A minimum 100 percent shall pass through a 2.36 mm sieve and a minimum 97 percent shall pass through a 0.25 mm sieve.

##### 2.3.1.3 Burnt Lime

Burnt lime shall contain a minimum calcium carbonate equivalent of 140 percent. Gradation: A minimum 95 percent shall pass through a 2.36 mm sieve and a minimum 35 percent shall pass through a 0.25 mm sieve.

#### 2.3.2 Fertilizer

It shall be as recommended by the soil test. Fertilizer shall be controlled release commercial grade; free flowing, pellet or tablet form; uniform in composition; and consist of a nitrogen-phosphorus-potassium ratio. The fertilizer shall be derived from sulphur coated urea, urea formaldehyde, plastic or polymer coated pills, or isobutylenediurea (IBDU). Fertilizer shall be balanced with the inclusion of trace minerals and micro-nutrients.

#### 2.3.3 Organic Material

Organic material shall consist of either bonemeal, peat, rotted manure, decomposed wood derivatives, recycled compost, or worm castings.

##### 2.3.3.1 Bonemeal

Bonemeal shall be a finely ground, steamed bone product containing from 2 to 4 percent nitrogen and 16 to 40 percent phosphoric acid.

##### 2.3.3.2 Rotted Manure

Rotted manure shall be unleached horse, chicken, or cattle manure containing a maximum 25 percent by volume of straw, sawdust, or other bedding materials. Manure shall contain no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds and shall be free of stones, sticks, and soil.

##### 2.3.3.3 Decomposed Wood Derivatives

Decomposed wood derivatives shall be ground bark, sawdust, or other wood waste material free of stones, sticks, and toxic substances harmful to plants, and stabilized with nitrogen.

##### 2.3.3.4 Recycled Compost

Compost shall be a well decomposed, stable, weed free organic matter source.

It shall be derived from food, agricultural, or industrial residuals; biosolids (treated sewage sludge); yard trimmings; or source-separated or mixed solid waste. The compost shall possess no objectionable odors and shall not resemble the raw material from which it was derived. The material shall not contain substances toxic to plants. Gradation: The compost material shall pass through a 10 mm screen, possess a pH of 5.5 to 8.0, and have a moisture content between 35-55 percent by weight. The material shall not contain more than 1 percent or less by weight of man-made foreign matter. Compost shall be cleaned of plastic materials larger than 50 mm in length.

##### 2.3.3.5 Worm Castings

Worm castings shall be screened from worms and food source and shall be commercially packaged.

#### 2.3.4 Soil Conditioner

Soil conditioner shall be sand, super absorbent polymers, calcined clay, or gypsum for single use or in combination to meet topsoil requirements for the plant material specified.

##### 2.3.4.1 Sand

Sand shall be clean and free of toxic materials. Gradation: A minimum 95 percent by weight shall pass a 2 mm sieve and a minimum 10 percent by weight shall pass a 1.18 mm sieve. Greensand shall be balanced with the inclusion of trace minerals and nutrients.

##### 2.3.4.2 Super Absorbent Polymers

To improve water retention in soils, super absorbent polymers shall be sized according to manufacturer's recommendations. Polymers shall be added as a soil amendment and be cross-linked polyacrylamide with an absorption capacity of 250-400 times its weight.

##### 2.3.4.3 Calcined Clay

Granular particles shall be produced from montmorillonite clay calcined to minimum temperature of 650 degrees C. Gradation: A minimum 90 percent passing 2.36 mm sieve; a minimum 99 percent shall be retained on 0.25 mm sieve; and a maximum 2 percent shall pass a 0.15 mm sieve. Bulk density: A maximum 640 kilogram per cubic meter .

##### 2.3.4.4 Gypsum

Gypsum shall be commercially packaged, free flowing, and a minimum 95 percent calcium sulfate by volume.

##### 2.3.4.5 Expanded Shale, Clay, or Slate (ESCS)

Rotary kiln produced ESCS material shall be in conformance with ASTM D 5883.

#### 2.4 MULCH

Mulch shall be free from weeds, mold, and other deleterious materials. Mulch materials shall be native to the region. Rotted manure is not recommended to be used as a mulch because it would encourage surface rooting of the plant material and weeds.

##### 2.4.1 Organic Mulch

Organic mulch materials shall be native to the project site and consist of recycled mulch, shredded bark, wood chips, or ground bark.

##### 2.4.1.1 Recycled Mulch

Recycled mulch may include compost, tree trimmings, or pine needles with a gradation that passes through a 65 x 65 mm screen. It shall be cleaned of all sticks a minimum 25 mm in diameter and plastic materials a minimum 75 mm length. The material shall be treated to retard the growth of mold and fungi. Other recycled mulch may include peanut shells, pecan shells or coco bean shells.

#### 2.4.1.2 Shredded Bark

Locally shredded material shall be treated to retard the growth of mold and fungi.

#### 2.4.1.3 Wood Chips and Ground Bark

Locally chipped or ground material shall be treated to retard the growth of mold and fungi. Gradation: A maximum 50 mm wide by 100 mm long.

### 2.5 METAL STAKING AND GUYING MATERIAL

Metal staking and guying shall be as shown on drawings.

### 2.6 RUBBER GUYING MATERIAL

Rubber chafing guards, consisting of recycled material, shall be used to protect tree trunks and branches when metal guying material is applied. The material shall be the same color throughout the project. Length shall be a minimum 1.5 times the circumference of the plant trunk at its base.

### 2.7 FLAG

Plastic flag material shall be used on guying material. It shall be a minimum 150 mm long. Tape color shall be consistent and visually complimentary to the entire project area. The tape color shall meet pedestrian visual safety requirements for day and night.

### 2.8 MYCORRHIZAL FUNGI INOCULUM

Mycorrhizal fungi inoculum shall be composed of multiple-fungus inoculum as recommended by the manufacturer for the plant material specified.

### 2.9 WATER

Unless otherwise directed, water shall be the responsibility of the Contractor. Water shall not contain elements toxic to plant life.

### 2.10 PESTICIDE

Pesticide shall be insecticide, herbicide, fungicide, nematocide, rodenticide or miticide. For the purpose of this specification a soil fumigant shall have the same requirements as a pesticide. The pesticide material shall be EPA registered and approved.

## PART 3 EXECUTION

### 3.1 INSTALLING PLANT MATERIAL TIME AND CONDITIONS

#### 3.1.1 Deciduous Plant Material Time

Deciduous plant material shall be installed from September. 1 to May 31 or as otherwise approved by Contracting Officer.

#### 3.1.2 Evergreen Plant Material Time

Evergreen plant material shall be installed from September 1 to May 31 or as otherwise approved by Contracting Officer.

#### 3.1.3 Plant Material Conditions

Planting operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, frozen ground or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the planting operations, proposed planting times shall be submitted for approval.

#### 3.1.4 Tests

##### 3.1.4.1 Percolation Test

Test for percolation shall be done to determine positive drainage of plant pits and beds. A positive percolation shall consist of a minimum 25 mm per 3 hours; when a negative percolation test occurs, a shop drawing shall be submitted indicating the corrective measures.

##### 3.1.4.2 Soil Test

Delivered topsoil, excavated plant pit soil, and stockpiled topsoil shall be tested in accordance with ASTM D 5268 and ASTM D 4972 for determining the particle size, pH, organic matter content, textural class, chemical analysis, soluble salts analysis, and mechanical analysis. Sample collection onsite shall be random over the entire site. Sample collection for stockpiled topsoil shall be at different levels in the stockpile. The soil shall be free from debris, noxious weeds, toxic substances, or other materials harmful to plant growth. The test shall determine the quantities and type of soil amendments required to meet local growing conditions for the plant material specified.

### 3.2 SITE PREPARATION

#### 3.2.1 Finished Grade, Topsoil and Underground Utilities

The Contractor shall verify that finished grades are as indicated on drawings, and that the placing of topsoil, the smooth grading, and the compaction requirements have been completed in accordance with Section 02300 EARTHWORK, prior to the commencement of the planting operation. The location of underground utilities and facilities in the area of the planting operation shall be verified. Damage to underground utilities and facilities shall be repaired at the Contractor's expense.

### 3.2.2 Layout

Plant material locations and bed outlines shall be staked on the project site before any excavation is made. Plant material locations may be adjusted to meet field conditions.

### 3.2.3 Protecting Existing Vegetation

When there are established lawns in the planting area, the turf shall be covered and/or protected during planting operations. Existing trees, shrubs, and plant beds that are to be preserved shall be barricaded along the dripline to protect them during planting operations.

## 3.3 EXCAVATION

### 3.3.1 Obstructions Below Ground

When obstructions below ground affect the work, shop drawings showing proposed adjustments to plant material location, type of plant and planting method shall be submitted for approval.

### 3.3.2 Turf Removal

Where the planting operation occurs in an existing lawn area, the turf shall be removed from the excavation area to a depth that will ensure the removal of the entire root system.

### 3.3.3 Plant Pits

Plant pits for ball and burlapped or container plant material shall be dug to a depth equal to the height of the root ball as measured from the base of the ball to the base of the plant trunk. Plant pits for bare-root plant material shall be dug to a depth equal to the height of the root system. Plant pits shall be dug a minimum 50 percent wider than the ball or root system to allow for root expansion. The pit shall be constructed with sides sloping towards the base as a cone, to encourage well aerated soil to be available to the root system for favorable root growth. Cylindrical pits with vertical sides shall not be used.

## 3.4 INSTALLATION

### 3.4.1 Setting Plant Material

Plant material shall be set plumb and held in position until sufficient soil has been firmly placed around root system or ball. In relation to the surrounding grade, the plant material shall be set even with the grade at which it was grown.

#### 3.4.1.1 Bare-Root Plant Material

Bare-root plant material shall be placed in water a minimum 30 minutes prior to setting.

#### 3.4.2 Backfill Soil Mixture



The backfill soil mixture may be a mix of topsoil and soil amendments suitable for the plant material specified. When practical, the excavated soil from the plant pit that is not amended provides the best backfill and shall be used.

#### 3.4.3 Adding Mycorrhizal Fungi Inoculum

Mycorrhizal fungi inoculum shall be added as recommended by the manufacturer for the plant material specified.

#### 3.4.4 Backfill Procedure

Prior to backfilling, all metal, wood, synthetic products, or treated burlap devices shall be removed from the ball or root system avoiding damage to the root system. The backfill procedure shall remove air pockets from around the root system. Additional requirements are as follows.

##### 3.4.4.1 Balled and Burlapped, and Balled and Platformed Plant Material

Biodegradable burlap and tying material shall be carefully opened and folded back from the top a minimum 1/3 depth from the top of the root ball. Backfill mixture shall be added to the plant pit in 150 mm layers with each layer tamped.

##### 3.4.4.2 Bare-Root Plant Material

The root system shall be spread out and arranged in its natural position. Damaged roots shall be removed with a clean cut. The backfill soil mixture shall be carefully worked in amongst the roots and watered to form a soupy mixture. Air pockets shall be removed from around the root system, and root to soil contact shall be provided.

##### 3.4.4.3 Container-Grown and Balled and Potted Plant Material

The plant material shall be carefully removed from containers that are not biodegradable. Prior to setting the plant in the pit, a maximum 1/4 depth of the root mass, measured from the bottom, shall be spread apart to promote new root growth. For plant material in biodegradable containers the container shall be split prior to setting the plant with container. Backfill mixture shall be added to the plant pit in 150 mm layers with each layer tamped.

##### 3.4.4.4 Earth Berm

An earth berm, consisting of backfill soil mixture, shall be formed with a minimum 100 mm height around the edge of the plant pit to aid in water retention and to provide soil for settling adjustments.

#### 3.4.5 Plant Bed

Plant material shall be set in plant beds according to the drawings. Backfill soil mixture shall be placed on previously scarified subsoil to completely surround the root balls, and shall be brought to a smooth and

even surface, blending to existing areas. Earth berms shall be provided. Polymers shall be spread uniformly over the plant bed and in the planting pit as recommended by the manufacturer and thoroughly incorporated into the soil to a maximum 100 mm depth.

#### 3.4.6 Watering

Plant pits and plant beds shall be watered immediately after backfilling, until completely saturated.

#### 3.4.7 Staking and Guying

Staking will be required when trees are unstable or will not remain set due to their size, shape, or exposure to high wind velocity.

##### 3.4.7.1 One Bracing Stake

Trees 1200 to 1800 mm high shall be firmly anchored in place with one bracing stake. The bracing stake shall be placed on the side of the tree facing the prevailing wind. The bracing stake shall be driven vertically into firm ground and shall not injure the ball or root system. The tree shall be held firmly to the stake with a double strand of guying material. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. A chafing guard shall be used when metal is the guying material.

##### 3.4.7.2 Two Bracing Stakes

Trees from 1800 to 2400 m height shall be firmly anchored in place with 2 bracing stakes placed on opposite sides. Bracing stakes shall be driven vertically into firm ground and shall not injure the ball or root system. The tree shall be held firmly between the stakes with a double strand of guying material. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. Chafing guards shall be used when metal is the guying material.

##### 3.4.7.3 Three Ground Stakes

Trees over a minimum 2400 mm height and less than a maximum 150 mm caliper shall be held firmly in place with 3 bracing or ground stakes spaced equidistantly around the tree. Ground stakes shall be avoided in areas to be mowed. Stakes shall be driven into firm ground outside the earth berm. The guying material shall be firmly anchored at a minimum 1/2 tree height and shall prevent girdling. For trees over maximum 75 mm diameter at breast height, turnbuckles shall be used on the guying material for tree straightening purposes. One turnbuckle shall be centered on each guy line. Chafing guards shall be used when metal is the guying material.

#### 3.4.8 Flags

A flag shall be securely fastened to each guy line equidistant between the tree and the stake, deadmen, or earth anchor. The flag shall be visible to pedestrians.

### 3.5 FINISHING

#### 3.5.1 Plant Material

Prior to placing mulch, the installed area shall be uniformly edged to provide a clear division line between the planted area and the adjacent turf area, shaped as indicated. The installed area shall be raked and smoothed while maintaining the earth berms.

#### 3.5.2 Placing Mulch

The placement of mulch shall occur a maximum 48 hours after planting. Mulch, used to reduce soil water loss, regulate soil temperature and prevent weed growth, shall be spread to cover the installed area with a minimum 100 mm uniform thickness. Mulch shall be kept out of the crowns of shrubs, ground cover, and vines and shall be kept off buildings, sidewalks and other facilities.

#### 3.5.3 Pruning

Pruning shall be accomplished by trained and experienced personnel. The pruning of trees and palms shall be in accordance with ANSI A300. Only dead or broken material shall be pruned from installed plants. The typical growth habit of individual plant material shall be retained. Clean cuts shall be made flush with the parent trunk. Improper cuts, stubs, dead and broken branches shall be removed. "Headback" cuts at right angles to the line of growth will not be permitted. Trees shall not be poled or the leader removed, nor shall the leader be pruned or "topped off".

### 3.6 MAINTENANCE DURING PLANTING OPERATION

Installed plant material shall be maintained in a healthy growing condition. Maintenance operations shall begin immediately after each plant is installed to prevent desiccation and shall continue until the plant establishment period commences. Installed areas shall be kept free of weeds, grass, and other undesired vegetation. The maintenance includes maintaining the mulch, watering, and adjusting settling.

### 3.7 APPLICATION OF PESTICIDE

When application of a pesticide becomes necessary to remove a pest or disease, a pesticide treatment plan shall be submitted and coordinated with the installation pest management program.

#### 3.7.1 Technical Representative

The certified installation pest management coordinator shall be the technical representative, and shall be present at all meetings concerning treatment measures for pest or disease control. They may be present during treatment application.

#### 3.7.2 Application

A state certified applicator shall apply required pesticides in accordance with EPA label restrictions and recommendations. Clothing and personal protective equipment shall be used as specified on the pesticide label. A closed system is recommended as it prevents the pesticide from coming into contact with the applicator or other persons. Water for formulating shall only come from designated locations. Filling hoses shall be fitted with a backflow preventer meeting local plumbing codes or standards. Overflow shall be prevented during the filling operation. Prior to each day of use, the equipment used for applying pesticide shall be inspected for leaks, clogging, wear, or damage. Any repairs are to be performed immediately.

### 3.8 RESTORATION AND CLEAN UP

#### 3.8.1 Restoration

Turf areas, pavements and facilities that have been damaged from the planting operation shall be restored to original condition at the Contractor's expense.

#### 3.8.2 Clean Up

Excess and waste material shall be removed from the installed area and shall be disposed offsite. Adjacent paved areas shall be cleared.

### 3.9 PLANT ESTABLISHMENT PERIOD

#### 3.9.1 Commencement

Upon completion of the last day of the planting operation, the plant establishment period for maintaining installed plant material in a healthy growing condition shall commence and shall be in effect for the remaining contract time period, not to exceed 12 months. Written calendar time period shall be furnished for the plant establishment period. When there is more than one plant establishment period, the boundaries of the planted area covered for each period shall be described. The plant establishment period shall be coordinated with Sections 02921 SEEDING; 02922 SODDING; and 02923 SPRIGGING. The plant establishment period shall be modified for inclement weather shut down periods, or for separate completion dates for areas.

#### 3.9.2 Maintenance During Establishment Period

Maintenance of plant material shall include straightening plant material, straightening stakes; tightening guying material; correcting girdling; supplementing mulch; pruning dead or broken branch tips; maintaining plant material labels; watering; eradicating weeds, insects and disease; post-fertilization; and removing and replacing unhealthy plants.

##### 3.9.2.1 Watering Plant Material

The plant material shall be watered as necessary to prevent desiccation and to maintain an adequate supply of moisture within the root zone. An adequate supply of moisture is estimated to be the equivalent of 25 mm absorbed water per week, delivered in the form of rain or augmented by watering. Run-off, puddling and wilting shall be prevented. Unless

otherwise directed, watering trucks shall not be driven over turf areas. Watering of other adjacent areas or existing plant material shall be prevented.

#### 3.9.2.2 Weeding

Grass and weeds in the installed areas shall not be allowed to reach a maximum 75 mm height before being completely removed, including the root system.

#### 3.9.2.3 Pesticide Treatment

Treatment for disease or pest shall be in accordance with paragraph APPLICATION OF PESTICIDE.

#### 3.9.2.4 Post-Fertilization

The plant material shall be topdressed at least once during the period of establishment with controlled release fertilizer, reference paragraph SOIL AMENDMENTS. Apply at the rate of 1 kilogram per 10 square meters of plant pit or bed area. Dry fertilizer adhering to plants shall be flushed off. The application shall be timed prior to the advent of winter dormancy.

#### 3.9.2.5 Plant Pit Settling

When settling occurs to the backfill soil mixture, additional backfill soil shall be added to the plant pit or plant bed until the backfill level is equal to the surrounding grade. Serious settling that affects the setting of the plant in relation to the maximum depth at which it was grown requires replanting in accordance with paragraph INSTALLATION. The earth berm shall be maintained.

#### 3.9.2.6 Maintenance Record

A record shall be furnished describing the maintenance work performed, the quantity of plant losses, diagnosis of the plant loss, and the quantity of replacements made on each site visit.

#### 3.9.3 Unhealthy Plant Material

A tree shall be considered unhealthy or dead when the main leader has died back, or up to a maximum 25 percent of the crown has died. A shrub shall be considered unhealthy or dead when up to a maximum 25 percent of the plant has died. This condition shall be determined by scraping on a branch an area 2 mm square, maximum, to determine if there is a green cambium layer below the bark. The Contractor shall determine the cause for unhealthy plant material and shall provide recommendations for replacement. Unhealthy or dead plant material shall be removed immediately and shall be replaced as soon as seasonal conditions permit.

#### 3.9.4 Replacement Plant Material

Unless otherwise directed, plant material shall be provided for replacement in accordance with paragraph PLANT MATERIAL. Replacement plant material

shall be installed in accordance with paragraph INSTALLATION, and recommendations in paragraph PLANT ESTABLISHMENT PERIOD. Plant material shall be replaced in accordance with paragraph WARRANTY. An extended plant establishment period shall not be required for replacement plant material.

#### 3.9.5 Maintenance Instructions

Written instructions shall be furnished containing drawings and other necessary information for year-round care of the installed plant material; including, when and where maintenance should occur, and the procedures for plant material replacement,.

-- End of Section --

DIVISION 3 – CONCRETE

03100	Structural Concrete Formwork
03150	Expansion Joints, Contraction Joints, and Waterstops
03200	Concrete Reinforcement
03300	Cast-in-Place Structural Concrete

## SECTION 03100

## STRUCTURAL CONCRETE FORMWORK

05/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ACI INTERNATIONAL (ACI)

ACI 347R (1994) Guide to Formwork for Concrete

## AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA ANSI/AHA A135.4 (1995) Basic Hardboard

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 578 (1995) Rigid, Cellular Polystyrene Thermal Insulation

## DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1996) Voluntary Product Standard - Construction and Industrial Plywood

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

SD-02 Shop Drawings

Concrete Formwork; GA-BK, GA-CH, GA-DN, GA-HQ.



Drawings showing details of formwork, including dimensions of fiber voids, joints, supports, studding and shoring, and sequence of form and shoring removal.

#### SD-03 Product Data

Form Materials; GA-BK, GA-CH, GA-DN, GA-HQ.

Manufacturer's data including literature describing form materials, accessories, and form releasing agents.

#### SD-05 Design Data

##### Design

Design analysis and calculations for form design and methodology used in the design.

#### SD-08 Manufacturer's Instructions

##### Form Releasing Agents

Manufacturer's recommendation on method and rate of application of form releasing agents.

### 1.3 DESIGN

Formwork shall be designed in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses. Forms shall be capable of producing a surface which meets the requirements of the class of finish specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

### 1.4 STORAGE AND HANDLING

Fiber voids shall be stored above ground level in a dry location. Fiber voids shall be kept dry until installed and overlaid with concrete.

## PART 2 PRODUCTS

### 2.1 FORM MATERIALS

#### 2.1.1 Forms For Class B Finish

Forms for Class A and Class B finished surfaces shall be plywood panels conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II. Other form materials or liners may be used provided the smoothness and appearance of concrete produced will be equivalent to that produced by the plywood concrete form panels. Forms for round columns shall be the prefabricated seamless type.

#### 2.1.2 Forms For Class C Finish

Forms for Class C finished surfaces shall be shiplap lumber; plywood conforming to DOC PS 1, Grade B-B concrete form panels, Class I or II; tempered concrete form hardboard conforming to AHA ANSI/AHA A135.4; other approved concrete form material; or steel, except that steel lining on wood sheathing shall not be used. Forms for round columns may have one vertical seam.

#### 2.1.3 Forms For Class D Finish

Forms for Class D finished surfaces, except where concrete is placed against earth, shall be wood or steel or other approved concrete form material.

#### 2.1.4 Retain-In-Place Metal Forms

Retain-in-place metal forms for concrete slabs and roofs shall be as specified in Section 05300 STEEL DECKING.

#### 2.1.5 Form Ties

Form ties shall be factory-fabricated metal ties, shall be of the removable or internal disconnecting or snap-off type, and shall be of a design that will not permit form deflection and will not spall concrete upon removal. Solid backing shall be provided for each tie. Except where removable tie rods are used, ties shall not leave holes in the concrete surface less than 6 mm nor more than 25 mm deep and not more than 25 mm in diameter. Removable tie rods shall be not more than 38 mm in diameter.

#### 2.1.6 Form Releasing Agents

Form releasing agents shall be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Formwork

Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the surface requirements specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE and conforming to construction tolerance given in TABLE 1. Where concrete surfaces are to have a Class A or Class B finish, joints in form panels shall be arranged as approved. Where forms for continuous surfaces are placed in successive units, the forms shall fit over the completed surface to obtain accurate alignment of the surface and to prevent leakage of mortar. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. Surfaces of forms to be reused shall be cleaned of mortar from previous concreting and of all other foreign material before reuse. Form ties that are to be completely withdrawn shall be coated with a nonstaining bond breaker.

### 3.2 CHAMFERING

Except as otherwise shown, external corners that will be exposed shall be chamfered, beveled, or rounded by moldings placed in the forms.

### 3.3 COATING

Forms for Class A and Class B finished surfaces shall be coated with a form releasing agent before the form or reinforcement is placed in final position. The coating shall be used as recommended in the manufacturer's printed or written instructions. Forms for Class C and D finished surfaces may be wet with water in lieu of coating immediately before placing concrete, except that in cold weather with probable freezing temperatures, coating shall be mandatory. Surplus coating on form surfaces and coating on reinforcing steel and construction joints shall be removed before placing concrete.

### 3.4 REMOVAL OF FORMS

Forms shall be removed preventing injury to the concrete and ensuring the complete safety of the structure. Formwork for columns, walls, side of beams and other parts not supporting the weight of concrete may be removed when the concrete has attained sufficient strength to resist damage from the removal operation but not before at least 24 hours has elapsed since concrete placement. Supporting forms and shores shall not be removed from beams, floors and walls until the structural units are strong enough to carry their own weight and any other construction or natural loads. Supporting forms or shores shall not be removed before the concrete strength has reached 70 percent of design strength, as determined by field cured cylinders or other approved methods. This strength shall be demonstrated by job-cured test specimens, and by a structural analysis considering the proposed loads in relation to these test strengths and the strength of forming and shoring system. The job-cured test specimens for form removal purposes shall be provided in numbers as directed and shall be in addition to those required for concrete quality control. The specimens shall be removed from molds at the age of 24 hours and shall receive, insofar as possible, the same curing and protection as the structures they represent.

TABLE 1

#### TOLERANCES FOR FORMED SURFACES

1. Variations from the plumb:	In any 3 m of length -----	6 mm
a. In the lines and surfaces of columns, piers, walls and in arises	Maximum for entire length --	25 mm
b. For exposed corner columns, control-joint grooves, and other	In any 6 m of length -----	6 mm
	Maximum for entire length	13 mm

TABLE 1

TOLERANCES FOR FORMED SURFACES

conspicuous lines		
2.	Variation from the level or from the grades indicated on the drawings:	In any 3 m of length ----- 6 mm In any bay or in any 6 m of length ----- 10 mm
a.	In slab soffits, ceilings beam soffits, and in arises, measured before removal of supporting shores	Maximum for entire length - 20 mm
b.	In exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines	In any bay or in any 6 m of length ----- 6 mm Maximum for entire length - 13 mm
3.	Variation of the linear building lines from established position in plan	In any 6 m ----- 13 mm Maximum ----- 25 mm
4.	Variation of distance between walls, columns, partitions	6 mm per 3 m of distance, but not more than 13 mm in any one bay, and not more than 25 mm total variation
5.	Variation in the sizes and locations of sleeves, floor openings, and wall opening	Minus ----- 6 mm Plus ----- 13 mm
6.	Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls	Minus ----- 6 mm Plus ----- 13 mm
7.	Footings:	
a.	Variation of dimensions in plan	Minus ----- 13 mm Plus ----- 50 mm when formed or plus 75 mm when placed against unformed excavation
b.	Misplacement of	2 percent of the footing width

TABLE 1

TOLERANCES FOR FORMED SURFACES

eccentricity	in the direction of misplacement but not more than -----	50 mm
c. Reduction in thickness	Minus ----- of specified thickness	5 percent
8. Variation in steps:	Riser -----	3 mm
a. In a flight of stairs	Tread -----	6 mm
b. In consecutive steps	Riser ----- Tread -----	2 mm 3 mm
-- End of Section --		

## SECTION 03150

EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS  
05/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO T 111 (1983) Inorganic Matter or Ash in Bituminous Materials

## AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA ANSI/AHA A135.4 (1995) Basic Hardboard

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 109 (1993) Steel, Strip, Carbon, Cold-Rolled

ASTM A 109M (1991) Steel, Strip, Carbon, Cold-Rolled  
(Metric)

ASTM A 167 (1996) Stainless and Heat-Resisting  
Chromium-Nickel Steel Plate, Sheet, and Strip

ASTM A 480/A 480M (1996a) General Requirements for Flat-Rolled  
Stainless and Heat-Resisting Steel Plate,  
Sheet, and Strip

ASTM A 570/A 570M (1996) Steel, Sheet and Strip, Carbon,  
Hot-Rolled, Structural Quality

ASTM B 152 (1994) Copper Sheet, Strip, Plate, and Rolled  
Bar

ASTM B 152M (1995) Copper Sheet, Strip, Plate, and Rolled  
Bar (Metric)

ASTM B 370 (1992) Copper Sheet and Strip for Building  
Construction

ASTM C 919	(1984; R 1992) Use of Sealants in Acoustical Applications
ASTM C 920	(1995) Elastomeric Joint Sealants
ASTM D 4	(1986; R 1993) Bitumen Content
ASTM D 6	(1995) Loss on Heating of Oil and Asphaltic Compounds
ASTM D 412	(1997) Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension
ASTM D 471	(1996) Rubber Property - Effect of Liquids
ASTM D 1190	(1996) Concrete Joint Sealer, Hot-Applied Elastic Type
ASTM D 1191	(1984; R 1994) Test Methods for Concrete Joint Sealers
ASTM D 1751	(1983; R 1991) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D 1854	(1996) Specification for Jet-Fuel-Resistant Concrete Joint Sealer, Hot-Poured Elastic Type
ASTM D 1855	(1989) Test Method for Jet-Fuel Resistant Concrete Joint Sealer, Hot-Applied Elastic Type
ASTM D 2628	(1991) Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
ASTM D 2835	(1989; R 1993) Lubricant for Installation of Preformed Compression Seals in Concrete Pavements
ASTM D 5249	(1995) Backer Material for Use With Cold and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints

## CORPS OF ENGINEERS (COE)

COE CRD-C 513	(1974) Corps of Engineers Specifications for Rubber Waterstops
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COE CRD-C 572

(1974) Corps of Engineers Specifications for  
Polyvinylchloride Waterstop

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Waterstops; GA-BK, GA-CH, GA-DN, GA-HQ.

Shop drawings and fabrication drawings provided by the manufacturer or prepared by the Contractor.

## SD-03 Product Data

Preformed Expansion Joint Filler; GA-BK, GA-CH, GA-DN, GA-HQ. Sealant; GA-BK, GA-CH, GA-DN, GA-HQ. Waterstops; GA-BK, GA-CH, GA-DN, GA-HQ.

Manufacturer's literature, including safety data sheets, for preformed fillers and the lubricants used in their installation; field-molded sealants and primers (when required by sealant manufacturer); preformed compression seals; and waterstops.

## SD-04 Samples

## Preformed Compression Seals and Lubricants

Specimens identified to indicate the manufacturer, type of material, size and quantity of material, and shipment or lot represented. Each sample shall be a piece not less than 3 m of 25 mm nominal width or wider seal or a piece not less than 4 m of compression seal less than 25 mm nominal width. One liter of lubricant shall be provided.

## Field-Molded Type

Four liters of field-molded sealant and one liter of primer (when primer is recommended by the sealant manufacturer) identified to indicate manufacturer, type of material, quantity, and shipment or lot represented.

## Non-metallic Materials

Specimens identified to indicate manufacturer, type of material, size, quantity of material, and shipment or lot represented. Each sample shall be a piece not less than 300 mm long cut from each 61 m of finished waterstop furnished, but not less than a total of 1 m of each type, size, and lot furnished. One splice sample of each size and type for every 50 splices made in the factory and every 10 splices made at the job site. The splice samples shall be made using straight run pieces with the splice located at the mid-length of the sample and finished as required for the installed waterstop. The total length of each splice shall be not less than 300 mm



long.

#### SD-07 Certificates

Preformed Expansion Joint Filler Sealant Waterstops

Certificates of compliance stating that the joint filler and sealant materials and waterstops conform to the requirements specified.

#### SD-08 Manufacturer's Instructions

Preformed Expansion Joint Filler Sealant Waterstops

Manufacturer's recommended instructions for installing preformed fillers, field-molded sealants; preformed compression seals; and waterstops; and for splicing non-metallic waterstops.

### 1.3 DELIVERY AND STORAGE

Material delivered and placed in storage shall be stored off the ground and protected from moisture, dirt, and other contaminants. Sealants shall be delivered in the manufacturer's original unopened containers. Sealants whose shelf life has expired shall be removed from the site.

## PART 2 PRODUCTS

### 2.1 CONTRACTION JOINT STRIPS

Contraction joint strips shall be 3 mm (1/8 inch) thick tempered hardboard conforming to AHA ANSI/AHA A135.4, Class 1. In lieu of hardboard strips, rigid polyvinylchloride (PVC) or high impact polystyrene (HIPS) insert strips specifically designed to induce controlled cracking in slabs on grade may be used. Such insert strips shall have removable top section.

### 2.2 PREFORMED EXPANSION JOINT FILLER

Expansion joint filler shall be preformed material conforming to ASTM D 1751 or ASTM D 1752. Unless otherwise indicated, filler material shall be 10 mm (3/8 inch) thick and of a width applicable for the joint formed. Backer material, when required, shall conform to ASTM D 5249.

### 2.3 SEALANT

Joint sealant shall conform to the following:

#### 2.3.1 Hot-Poured Type

ASTM D 1190 tested in accordance with ASTM D 1191.

#### 2.3.2 Field Molded Type

ASTM C 920, Type M for horizontal joints or Type NS for vertical joints, Class 25, and Use NT. Bond breaker material shall be polyethylene tape, coated paper, metal foil or similar type materials. The back-up material

shall be compressible, non-shrink, nonreactive with sealant, and non-absorptive material type such as extruded butyl or polychloroprene rubber.

## 2.4 WATERSTOPS

Intersection and change of direction waterstops shall be shop fabricated.

### 2.4.1 Rigid Metal

Flat steel waterstops shall conform to ASTM A 109M , No. 2 (half hard) temper, No. 2 edge, No. 1 (matte or dull) finish or ASTM A 570/A 570M, Grade 40.

### 2.4.2 Non-Metallic Materials`

Non-metallic waterstops shall be manufactured from a prime virgin resin; reclaimed material is not acceptable. The compound shall contain plasticizers, stabilizers, and other additives to meet specified requirements. Rubber waterstops shall conform to COE CRD-C 513. Polyvinylchloride waterstops shall conform to COE CRD-C 572. Thermoplastic elastomeric rubber waterstops shall conform to ASTM D 471.

### 2.4.3 Non-Metallic Hydrophilic

Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water shall conform to ASTM D 412 as follows: Tensile strength 2.9 MPa minimum; ultimate elongation 600 percent minimum. Hardness shall be 50 minimum on the type A durometer and the volumetric expansion ratio in distilled water at 20 degrees C shall be 3 to 1 minimum.

### 2.4.4 Preformed Elastic Adhesive

Preformed plastic adhesive waterstops shall be produced from blends of refined hydrocarbon resins and plasticizing compounds reinforced with inert mineral filler, and shall contain no solvents, asbestos, irritating fumes or obnoxious odors. The compound shall not depend on oxidizing, evaporating, or chemical action for its adhesive or cohesive strength.

#### 2.4.4.1 Chemical Composition

The chemical composition of the sealing compound shall meet the requirements shown below:

#### PERCENT BY WEIGHT

COMPONENT	MIN.	MAX.	TEST
Bitumen (Hydrocarbon plastic)	50	70	ASTM D 4
Inert Mineral Filler	30	50	AASHTO T 111
Volatile Matter		2	ASTM D 6

#### 2.4.4.2 Adhesion Under Hydrostatic Pressure

The sealing compound shall not leak at the joints for a period of 24 hours under a vertical 2 m head pressure. In a separate test, the sealing compound shall not leak under a horizontal pressure of 65 kPa which is reached by slowly applying increments of 13 kPa every minute.

#### 2.4.4.3 Sag of Flow Resistance

Sagging shall not be detected when tested as follows: Fill a wooden form 25 mm wide and 150 mm long flush with sealing compound and place in an oven at 58 degrees C in a vertical position for 5 days.

#### 2.4.4.4 Chemical Resistance

The sealing compound when immersed separately in a 5% solution of caustic potash, a 5% solution of hydrochloric acid, 5% solution of sulfuric acid and a saturated hydrogen sulfide solution for 30 days at ambient room temperature shall show no visible deterioration.

### PART 3 EXECUTION

#### 3.1 JOINTS

Joints shall be installed at locations indicated and as authorized.

##### 3.1.1 Contraction Joints

Contraction joints may be constructed by inserting tempered hardboard strips or rigid PVC or HIPS insert strips into the plastic concrete using a steel parting bar, when necessary, or by cutting the concrete with a saw after concrete has set. Joints shall be approximately 3 mm wide and shall extend into the slab one-fourth the slab thickness, minimum, but not less than 25 mm.

##### 3.1.1.1 Joint Strips

Strips shall be of the required dimensions and as long as practicable. After the first floating, the concrete shall be grooved with a tool at the joint locations. The strips shall be inserted in the groove and depressed until the top edge of the vertical surface is flush with the surface of the slab. The slab shall be floated and finished as specified. Working of the concrete adjacent to the joint shall be the minimum necessary to fill voids and consolidate the concrete. Where indicated, the top portion of the strip shall be sawed out after the curing period to form a recess for sealer. The removable section of PVC or HIPS strips shall be discarded and the insert left in place. True alignment of the strips shall be maintained during insertion.

##### 3.1.1.2 Sawed Joints

Joint sawing shall be early enough to prevent uncontrolled cracking in the slab, but late enough that this can be accomplished without appreciable spalling. Concrete sawing machines shall be adequate in number and power, and with sufficient replacement blades to complete the sawing at the required rate. Joints shall be cut to true alignment and shall be cut in

sequence of concrete placement. Sludge and cutting debris shall be removed.

### 3.1.2 Expansion Joints

Preformed expansion joint filler shall be used in expansion and isolation joints in slabs around columns and between slabs on grade and vertical surfaces where indicated. The filler shall extend the full slab depth, unless otherwise indicated. The edges of the joint shall be neatly finished with an edging tool of 3 mm (1/8 inch) radius, except where a resilient floor surface will be applied. Where the joint is to receive a sealant, the filler strips shall be installed at the proper level below the finished floor with a slightly tapered, dressed and oiled wood strip temporarily secured to the top to form a recess to the size shown on the drawings. The wood strip shall be removed after the concrete has set. Contractor may opt to use a removable expansion filler cap designed and fabricated for this purpose in lieu of the wood strip. The groove shall be thoroughly cleaned of laitance, curing compound, foreign materials, protrusions of hardened concrete, and any dust which shall be blown out of the groove with oil-free compressed air.

### 3.1.3 Joint Sealant

Sawed contraction joints and expansion joints in slabs shall be filled with joint sealant, unless otherwise shown. Joint surfaces shall be clean, dry, and free of oil or other foreign material which would adversely affect the bond between sealant and concrete. Joint sealant shall be applied as recommended by the manufacturer of the sealant.

#### 3.1.3.1 Joints With Field-Molded Sealant

Joints shall not be sealed when the sealant material, ambient air, or concrete temperature is less than 4 degrees C . When the sealants are meant to reduce the sound transmission characteristics of interior walls, ceilings, and floors the guidance provided in ASTM C 919 shall be followed. Joints requiring a bond breaker shall be coated with curing compound or with bituminous paint. Bond breaker and back-up material shall be installed where required. Joints shall be primed and filled flush with joint sealant in accordance with the manufacturer's recommendations.

### 3.2 WATERSTOPS, INSTALLATION AND SPLICES

Waterstops shall be installed at the locations shown to form a continuous water-tight diaphragm. Adequate provision shall be made to support and completely protect the waterstops during the progress of the work. Any waterstop punctured or damaged shall be repaired or replaced. Exposed waterstops shall be protected during application of form release agents to avoid being coated. Suitable guards shall be provided to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued. Splices shall be made by certified trained personnel using approved equipment and procedures.

#### 3.2.1 Copper And Stainless Steel

Splices in copper waterstops shall be lap joints made by brazing. Splices

in stainless steel waterstops shall be welded using a TIG or MIG process utilizing a weld rod to match the stainless. All welds shall not be annealed to maintain physical properties. Carbon flame shall not be used in the annealing process. Damaged waterstops shall be repaired by removing damaged portions and patching. Patches shall overlap a minimum of 25 mm onto undamaged portion of the waterstop.

### 3.2.2 Flat Steel

Splices in flat steel waterstops shall be properly aligned, butt welded, and cleaned of excessive material.

### 3.2.3 Non-Metallic

Fittings shall be shop made using a machine specifically designed to mechanically weld the waterstop. A miter guide, proper fixturing (profile dependant), and portable power saw shall be used to miter cut the ends to be joined to ensure good alignment and contact between joined surfaces. The splicing of straight lengths shall be done by squaring the ends to be joined. Continuity of the characteristic features of the cross section of the waterstop (ribs, tabular center axis, protrusions, etc.) shall be maintained across the splice.

#### 3.2.3.1 Rubber Waterstop

Splices shall be vulcanized or shall be made using cold bond adhesive as recommended by the manufacturer. Splices for TPE-R shall be as specified for PVC.

#### 3.2.3.2 Polyvinyl Chloride Waterstop

Splices shall be made by heat sealing the adjacent waterstop edges together using a thermoplastic splicing iron utilizing a non-stick surface specifically designed for waterstop welding. The correct temperature shall be used to sufficiently melt without charring the plastic. The spliced area, when cooled, shall show no signs of separation, holes, or other imperfections when bent by hand in as sharp an angle as possible.

#### 3.2.3.3 Quality Assurance

Edge welding will not be permitted. Centerbulbs shall be compressed or closed when welding to non-centerbulb type. Waterstop splicing defects which are unacceptable include, but are not limited to the following: 1) Tensile strength less than 80 percent of parent section. 2) Free lap joints. 3) Misalignment of centerbulb, ribs, and end bulbs greater than 2 mm. 4) Misalignment which reduces waterstop cross section more than 15 percent. 5) Bond failure at joint deeper than 2 mm or 15 percent of material thickness. 6) Misalignment of waterstop splice resulting in misalignment of waterstop in excess of 13 mm in 3 m. 7) Visible porosity in the weld area, including pin holes. 8) Charred or burnt material. 9) Bubbles or inadequate bonding. 10) Visible signs of splice separation when cooled splice is bent by hand at a sharp angle.

### 3.2.4 Non-Metallic Hydrophilic Waterstop Installation

Ends to be joined shall be miter cut with sharp knife or shears. The ends shall be adhered with cyanacrylate (super glue) adhesive. When joining hydrophilic type waterstop to PVC waterstop, the hydrophilic waterstop shall be positioned as shown on the drawings. A liberal amount of a single component hydrophilic sealant shall be applied to the junction to complete the transition.

### 3.2.5 Preformed Plastic Adhesive Installation

The installation of preformed plastic adhesive waterstops shall be a prime, peel, place and pour procedure. Joint surfaces shall be clean and dry before priming and just prior to placing the sealing strips. The end of each strip shall be spliced to the next strip with a 25 mm overlap; the overlap shall be pressed firmly to release trapped air. During damp or cold conditions the joint surface shall be flashed with a safe, direct flame to warm and dry the surface adequately; the sealing strips shall be dipped in warm water to soften the material to achieve maximum bond to the concrete surface.

### 3.3 CONSTRUCTION JOINTS

Construction joints are specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE except that construction joints coinciding with expansion and contraction joints shall be treated as expansion or contraction joints as applicable.

-- End of Section --

## SECTION 03200

CONCRETE REINFORCEMENT  
**09/97**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ACI INTERNATIONAL (ACI)

ACI 318M (1995) Building Code Requirements for  
Structural Concrete and Commentary (Metric)

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53 (1999) Pipe, Steel, Black and Hot-Dipped,  
Zinc-Coated, Welded and Seamless

ASTM A 184/A 184M (1996) Fabricated Deformed Steel Bar Mats for  
Concrete Reinforcement

ASTM A 185 (1997) Steel Welded Wire Fabric, Plain, for  
Concrete Reinforcement

ASTM A 615/A 615M (1996a) Deformed and Plain Billet-Steel Bars  
for Concrete Reinforcement

ASTM A 675/A 675M (1990a; R 1995e1) Steel Bars, Carbon,  
Hot-Wrought, Special Quality, Mechanical  
Properties

ASTM A 706/A 706M (1998) Low-Alloy Steel Deformed and Plain Bars  
for Concrete Reinforcement

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.4 (1998) Structural Welding Code - Reinforcing  
Steel

## CONCRETE REINFORCING STEEL INSTITUTE (CRSI)

CRSI MSP-1 (1996) Manual of Standard Practice

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-02 Shop Drawings

Concrete Reinforcement System; GA-BK, GA-CH, GA-DN, GA-HQ.

Complete shop drawings shall be submitted. The shop drawings shall be prepared under the direct supervision of a licensed professional engineer. The shop drawings shall contain his seal and a statement certifying that they are in compliance with the specifications and contract drawings. The shop drawings shall include details of the bending and placing schedule of the steel reinforcement, together with bar schedules indicating the number, size, dimensions, and total length of various bars required. Bar lists and bending diagrams shall be checked for accuracy and completeness before the bars are fabricated. Details of typical supports for reinforcing steel shall be approved prior to placing any concrete. Shop drawings shall show all concrete dimensions, location of all construction joints shown on the drawings or proposed by the Contractor. The drawings shall show support details including types, sizes and spacing. Spacing between vertical reinforcing steel shall be shown on the wall elevations. The minimum scale used in the shop drawings shall be 3/8-inch to the foot (1:50). Reinforcement bending details shall conform to the requirements of ACI SP-66.

#### SD-07 Certificates

##### Reinforcing Steel

Certified copies of mill reports attesting that the reinforcing steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified herein, prior to the installation of reinforcing steel.

#### SD-08 Manufacturer's Instructions

##### Welding

A list of qualified welders names.

### 1.3 WELDING

Welders shall be qualified in accordance with AWS D1.4. Qualification test shall be performed at the worksite and the Contractor shall notify the Contracting Officer 24 hours prior to conducting tests. Special welding procedures and welders qualified by others may be accepted as permitted by AWS D1.4.

### 1.4 DELIVERY AND STORAGE

Reinforcement and accessories shall be stored off the ground on platforms, skids, or other supports.



## PART 2 PRODUCTS

### 2.1 DOWELS

Dowels shall conform to ASTM A 675/A 675M, Grade 80. Steel pipe conforming to ASTM A 53, Schedule 80, may be used as dowels provided the ends are closed with metal or plastic inserts or with mortar.

### 2.2 FABRICATED BAR MATS

Fabricated bar mats shall conform to ASTM A 184/A 184M.

### 2.3 REINFORCING STEEL

Reinforcing steel shall be deformed bars conforming to ASTM A 615/A 615M or ASTM A 706/A 706M, grades and sizes as indicated.

### 2.4 WELDED WIRE FABRIC

Welded wire fabric shall conform to ASTM A 185.

### 2.5 WIRE TIES

Wire ties shall be 16 gauge or heavier black annealed steel wire.

### 2.6 SUPPORTS

Bar supports for formed surfaces shall be designed and fabricated in accordance with CRSI MSP-1 and shall be steel or precast concrete blocks. Precast concrete blocks shall have wire ties and shall be not less than 100 by 100 mm when supporting reinforcement on ground. Precast concrete block shall have compressive strength equal to that of the surrounding concrete. Where concrete formed surfaces will be exposed to weather or where surfaces are to be painted, steel supports within 13 mm of concrete surface shall be galvanized, plastic protected or of stainless steel. Concrete supports used in concrete exposed to view shall have the same color and texture as the finish surface. For slabs on grade, supports shall be precast concrete blocks, plastic coated steel fabricated with bearing plates, or specifically designed wire-fabric supports fabricated of plastic.

## PART 3 EXECUTION

### 3.1 REINFORCEMENT

Reinforcement shall be fabricated to shapes and dimensions shown and shall conform to the requirements of ACI 318M. Reinforcement shall be cold bent unless otherwise authorized. Bending may be accomplished in the field or at the mill. Bars shall not be bent after embedment in concrete. Safety caps shall be placed on all exposed ends of vertical concrete reinforcement bars that pose a danger to life safety. Wire tie ends shall face away from the forms.

#### 3.1.1 Placement

Reinforcement shall be free from loose rust and scale, dirt, oil, or other deleterious coating that could reduce bond with the concrete.

Reinforcement shall be placed in accordance with ACI 318M at locations shown plus or minus one bar diameter. Reinforcement shall not be continuous through expansion joints and shall be as indicated through construction or contraction joints. Concrete coverage shall be as indicated or as required by ACI 318M. If bars are moved more than one bar diameter to avoid interference with other reinforcement, conduits or embedded items, the resulting arrangement of bars, including additional bars required to meet structural requirements, shall be approved before concrete is placed.

### 3.1.2 Splicing

Splices of reinforcement shall conform to ACI 318M and shall be made only as required or indicated. Splicing shall be by lapping or by mechanical or welded butt connection; except that lap splices shall not be used for bars larger than No. 11 unless otherwise indicated. Welding shall conform to AWS D1.4. Welded butt splices shall be full penetration butt welds. Lapped bars shall be placed in contact and securely tied or spaced transversely apart to permit the embedment of the entire surface of each bar in concrete.

Lapped bars shall not be spaced farther apart than one-fifth the required length of lap or 150 mm. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line.

### 3.2 WELDED-WIRE FABRIC PLACEMENT

Welded-wire fabric shall be placed in slabs as indicated. Fabric placed in slabs on grade shall be continuous between expansion, construction, and contraction joints. Fabric placement at joints shall be as indicated. Lap splices shall be made in such a way that the overlapped area equals the distance between the outermost crosswires plus 50 mm. Laps shall be staggered to avoid continuous laps in either direction. Fabric shall be wired or clipped together at laps at intervals not to exceed 1.2 m. Fabric shall be positioned by the use of supports.

### 3.3 DOWEL INSTALLATION

Dowels shall be installed in slabs on grade at locations indicated and at right angles to joint being doweled. Dowels shall be accurately positioned and aligned parallel to the finished concrete surface before concrete placement. Dowels shall be rigidly supported during concrete placement. One end of dowels shall be coated with a bond breaker.

-- End of Section --

## SECTION 03300

CAST-IN-PLACE STRUCTURAL CONCRETE  
**09/95**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ACI INTERNATIONAL (ACI)

ACI 117/117R	(1990; Errata) Standard Tolerances for Concrete Construction and Materials
ACI 211.1	(1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
ACI 211.2	(1998) Standard Practice for Selecting Proportions for Structural Lightweight Concrete
ACI 213R	(1987) Guide for Structural Lightweight Aggregate Concrete
ACI 214.3R	(1988) Simplified Version of the Recommended Practice for Evaluation of Strength Test Results of Concrete
ACI 301	(1996) Standard Specifications for Structural Concrete
ACI 303R	(1991) Guide to Cast-In-Place Architectural Concrete Practice
ACI 305R	(1991) Hot Weather Concreting
ACI 318/318R	(1999) Building Code Requirements for Structural Concrete and Commentary

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS  
(AASHTO)

AASHTO M 182	(1991; R 1996) Burlap Cloth Made From Jute or Kenaf
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## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 31/C 31M	(1998) Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(1999a) Concrete Aggregates
ASTM C 39	(1996) Compressive Strength of Cylindrical Concrete Specimens
ASTM C 42	(1999) Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C 78	(1994) Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)
ASTM C 94	(1999) Ready-Mixed Concrete
ASTM C 131	(1996) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1996a) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 143	(1998) Slump of Hydraulic Cement Concrete
ASTM C 150	(1998a) Portland Cement
ASTM C 171	(1997a) Sheet Materials for Curing Concrete
ASTM C 172	(1999) Sampling Freshly Mixed Concrete
ASTM C 173	(1994ael) Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 192/C 192M	(1998) Making and Curing Concrete Test Specimens in the Laboratory
ASTM C 231	(1997el) Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(1998) Air-Entraining Admixtures for Concrete
ASTM C 309	(1998a) Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 330	(1999) Lightweight Aggregates for Structural Concrete
ASTM C 494	(1999) Chemical Admixtures for Concrete
ASTM C 496	(1996) Splitting Tensile Strength of Cylindrical Concrete Specimens

ASTM C 552	(1991) Cellular Glass Thermal Insulation
ASTM C 567	(1999a) Unit Weight of Structural Lightweight Concrete
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	(1994) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 595	(1998) Blended Hydraulic Cements
ASTM C 595M	(1997) Blended Hydraulic Cements (Metric)
ASTM C 618	(1999) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 685	(1998a) Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C 881	(1999) Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C 937	(1997) Grout Fluidifier for Preplaced-Aggregate Concrete
ASTM C 940	(1998a) Expansion and Bleeding of Freshly Mixed Grouts for Preplaced-Aggregate Concrete in the Laboratory
ASTM C 989	(1999) Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM C 1017	(1998) Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C 1059	(1999) Latex Agents for Bonding Fresh to Hardened Concrete
ASTM C 1064/C 1064M	(1999) Temperature of Freshly Mixed Portland Cement Concrete
ASTM C 1077	(1998) Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
ASTM C 1107	(1999) Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C 1116	(1995) Fiber-Reinforced Concrete and Shotcrete

ASTM C 1240	(1999) Silica Fume for Use as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar and Grout
ASTM D 75	(1987; R 1997) Sampling Aggregates
ASTM D 1751	(1999) Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(1984; R 1996el) Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM E 96	(1995) Water Vapor Transmission of Materials
ASTM E 1155	(1996) Determining Floor Flatness and Levelness Using the F-Number System
ASTM E 1155M	(1996) Determining Floor Flatness and Levelness Using the F-Number System (Metric)

## CORPS OF ENGINEERS (COE)

COE CRD-C 94	(1995) Surface Retarders
COE CRD-C 104	(1980) Method of Calculation of the Fineness Modulus of Aggregate
COE CRD-C 400	(1963) Requirements for Water for Use in Mixing or Curing Concrete
COE CRD-C 521	(1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete
COE CRD-C 540	(1971; R 1981) Standard Specification for Nonbituminous Inserts for Contraction Joints in Portland Cement Concrete Airfield Pavements, Sawable Type
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstop

## NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44	(1997) NIST Handbook 44: Specifications, Tolerances, and Other Technical Requirements for Weighing and Measuring Devices
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## NATIONAL READY-MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA CPMB 100	(1996) Concrete Plant Standards
NRMCA TMMB 100	(1994) Truck Mixer Agitator and Front

## Discharge Concrete Carrier Standards

NRMCA QC 3

(1984) Quality Control Manual: Section 3,  
Plant Certifications Checklist: Certification  
of Ready Mixed Concrete Production Facilities

## 1.2 LUMP SUM CONTRACT

Under this type of contract concrete items will be paid for by lump sum and will not be measured. The work covered by these items consists of furnishing all concrete materials, reinforcement, miscellaneous embedded materials, and equipment, and performing all labor for the forming, manufacture, transporting, placing, finishing, curing, and protection of concrete in these structures.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-04 Samples

## Surface Retarder

Surface retarder material with manufacturer's instructions for application in conjunction with air-water cutting.

## SD-05 Design Data

Mixture Proportions; GA-BK, GA-CH, GA-DN, GA-HQ

The results of trial mixture design studies along with a statement giving the maximum nominal coarse aggregate size and the proportions of ingredients that will be used in the manufacture of each strength or class of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an approved independent commercial testing laboratory, showing that mixture design studies have been made with materials proposed for the project and that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the mixture design studies without additional tests to show that the quality of the concrete is satisfactory.

## SD-06 Test Reports

Testing and Inspection for Contractor Quality Control; GA-BK, GA-CH, GA-DN, GA-HQ

Certified copies of laboratory test reports, including mill tests and all other test data, for portland cement, blended cement, pozzolan, ground granulated blast furnace slag, silica fume, aggregate, admixtures, and curing compound proposed for use on this project.

## SD-07 Certificates

## Qualifications

Written documentation for Contractor Quality Control personnel.

## 1.4 QUALIFICATIONS

Contractor Quality Control personnel assigned to concrete construction shall be American Concrete Institute (ACI) Certified Workmen in one of the following grades or shall have written evidence of having completed similar qualification programs:

Concrete Field Testing Technician, Grade I  
 Concrete Laboratory Testing Technician, Grade I or II  
 Concrete Construction Inspector, Level II

The foreman or lead journeyman of the flatwork finishing crew shall have similar qualification for ACI Concrete Flatwork Technician/Finisher or equal, with written documentation.

## 1.5 GENERAL REQUIREMENTS

## 1.5.1 Tolerances

Except as otherwise specified herein, tolerances for concrete batching, mixture properties, and construction as well as definition of terms and application practices shall be in accordance with ACI 117/117R. Level and grade tolerance measurements of slabs shall be made as soon as possible after finishing; when forms or shoring are used, the measurements shall be made prior to removal.

## 1.5.1.1 Floors

For the purpose of this Section the following terminology correlation between ACI 117/117R and this Section shall apply:

Floor Profile Quality Classification From ACI 117/117R	This Section
-----	-----
Conventional Bullfloated	Same
Conventional Straightedged	Same
Flat	Float Finish or Trowel Finish
Very Flat	Same. Use only with F-system

Levelness tolerance shall not apply where design requires floors to be sloped to drains or sloped for other reasons.

## 1.5.1.2 Floors by the Straightedge System

The flatness of the floors shall be carefully controlled and the tolerances



shall be measured by the straightedge system as specified in paragraph 4.5.7 of ACI 117/117R, using a 3 m straightedge, within 72 hours after floor slab installation and before shores and/or forms are removed. The listed tolerances shall be met at any and every location at which the straightedge can be placed.

Bullfloated 3 mm  
Straightedged 3 mm  
Float Finish 3 mm  
Trowel Finish 3 mm

#### 1.5.2 Strength Requirements and w/c Ratio

##### 1.5.2.1 Strength Requirements

Specified compressive strength ( $f'_c$ ) shall be as shown on drawings:

Specified compressive strength ( $f'_c$ ) shall be as indicated on the drawings at 28 days.

Concrete made with high-early strength cement shall have a 7-day strength equal to the specified 28-day strength for concrete made with Type I or II portland cement. Compressive strength shall be determined in accordance with ASTM C 39.

- a. Evaluation of Concrete Compressive Strength. Compressive strength specimens (152 by 305 mm cylinders) shall be fabricated by the Contractor and laboratory cured in accordance with ASTM C 31/C 31M and tested in accordance with ASTM C 39. The strength of the concrete will be considered satisfactory so long as the average of all sets of three consecutive test results equals or exceeds the specified compressive strength  $f'_c$  and no individual test result falls below the specified strength  $f'_c$  by more than 3.5 MPa. A "test" is defined as the average of two companion cylinders, or if only one cylinder is tested, the results of the single cylinder test. Additional analysis or testing, including taking cores and/or load tests may be required at the Contractor's expense when the strength of the concrete in the structure is considered potentially deficient.
- b. Investigation of Low-Strength Compressive Test Results. When any strength test of standard-cured test cylinders falls below the specified strength requirement by more than 3.5 MPa or if tests of field-cured cylinders indicate deficiencies in protection and curing, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. When the strength of concrete in place is considered potentially deficient, cores shall be obtained and tested in accordance with ASTM C 42. At least three representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores will be determined by the Contracting Officer to least impair the strength of the structure. Concrete in the area represented by the core testing will be considered adequate if the average strength of the cores is equal to at least 85 percent of the

specified strength requirement and if no single core is less than 75 percent of the specified strength requirement. Non-destructive tests (tests other than test cylinders or cores) shall not be used as a basis for acceptance or rejection. The Contractor shall perform the coring and repair the holes. Cores will be tested by the Government.

- c. Load Tests. If the core tests are inconclusive or impractical to obtain or if structural analysis does not confirm the safety of the structure, load tests may be directed by the Contracting Officer in accordance with the requirements of ACI 318/318R. Concrete work evaluated by structural analysis or by results of a load test as being understrength shall be corrected in a manner satisfactory to the Contracting Officer. All investigations, testing, load tests, and correction of deficiencies shall be performed by and at the expense of the Contractor and must be approved by the Contracting Officer, except that if all concrete is found to be in compliance with the drawings and specifications, the cost of investigations, testing, and load tests will be at the expense of the Government.

#### 1.5.2.2 Water-Cement Ratio

Maximum water-cement ratio (w/c) for normal weight concrete shall be as shown on drawings:

##### All Concrete

These w/c's may cause higher strengths than that required above for compressive or flexural strength. The maximum w/c required will be the equivalent w/c as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations of ACI 211.1 for the term P which is used to denote the weight of pozzolan.

#### 1.5.3 Air Entrainment

Except as otherwise specified for lightweight concrete, all normal weight concrete shall be air entrained to contain between 4 and 7 percent total air, except that when the nominal maximum size coarse aggregate is 19 mm or smaller it shall be between 4.5 and 7.5 percent. Concrete with specified strength over 35 MPa may have 1.0 percent less air than specified above. Specified air content shall be attained at point of placement into the forms. Air content for normal weight concrete shall be determined in accordance with ASTM C 231.

#### 1.5.4 Slump

Slump of the concrete, as delivered to the point of placement into the forms, shall be within the following limits. Slump shall be determined in accordance with ASTM C 143.

Structural Element	Slump	
	Minimum	Maximum
Walls, columns and beams	50 mm	100 mm
Foundation walls, substructure walls, footings, slabs	25 mm	75 mm
Any structural concrete approved for placement by pumping:		
At pump	50 mm	150 mm
At discharge of line	25 mm	100 mm

When use of a plasticizing admixture conforming to ASTM C 1017 or when a Type F or G high range water reducing admixture conforming to ASTM C 494 is permitted to increase the slump of concrete, concrete shall have a slump of 50 to 100 mm before the admixture is added and a maximum slump of 200 mm at the point of delivery after the admixture is added.

#### 1.5.5 Concrete Temperature

The temperature of the concrete as delivered shall not exceed 32 degrees C. When the ambient temperature during placing is 5 degrees C or less, or is expected to be at any time within 6 hours after placing, the temperature of the concrete as delivered shall be between 12 and 25 degrees C.

#### 1.5.6 Size of Coarse Aggregate

The largest feasible nominal maximum size aggregate (NMSA) specified in paragraph AGGREGATES shall be used in each placement. However, nominal maximum size of aggregate shall not exceed any of the following: three-fourths of the minimum cover for reinforcing bars, three-fourths of the minimum clear spacing between reinforcing bars, one-fifth of the narrowest dimension between sides of forms, or one-third of the thickness of slabs or toppings.

#### 1.5.7 Special Properties and Products

Concrete may contain admixtures other than air entraining agents, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete, if specified or approved. Any of these materials to be used on the project shall be used in the mix design studies.

### 1.6 MIXTURE PROPORTIONS

Concrete shall be composed of portland cement, other cementitious and pozzolanic materials as specified, aggregates, water and admixtures as specified.

#### 1.6.1 Proportioning Studies for Normal Weight Concrete

Trial design batches, mixture proportioning studies, and testing

requirements for various classes and types of concrete specified shall be the responsibility of the Contractor. Except as specified for flexural strength concrete, mixture proportions shall be based on compressive strength as determined by test specimens fabricated in accordance with ASTM C 192/C 192M and tested in accordance with ASTM C 39. Samples of all materials used in mixture proportioning studies shall be representative of those proposed for use in the project and shall be accompanied by the manufacturer's or producer's test reports indicating compliance with these specifications. Trial mixtures having proportions, consistencies, and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios for each type of mixture, which will produce a range of strength encompassing those required for each class and type of concrete required on the project. The maximum water-cement ratios required in subparagraph Water-Cement Ratio will be the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus pozzolan, silica fume, and ground granulated blast furnace slag (GGBF slag) by the weight equivalency method as described in ACI 211.1. In the case where silica fume or GGBF slag is used, the weight of the silica fume and GGBF slag shall be included in the equations in ACI 211.1 for the term P, which is used to denote the weight of pozzolan. If pozzolan is used in the concrete mixture, the pozzolan content shall be 30 percent by weight of the total cementitious material. Laboratory trial mixtures shall be designed for maximum permitted slump and air content. Separate sets of trial mixture studies shall be made for each combination of cementitious materials and each combination of admixtures proposed for use. No combination of either shall be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, an accelerator or a retarder may be used without separate trial mixture study. Separate trial mixture studies shall also be made for concrete for any conveying or placing method proposed which requires special properties and for concrete to be placed in unusually difficult placing locations. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio, at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192/C 192M. They shall be tested at 7 and 28 days in accordance with ASTM C 39. From these test results, a curve shall be plotted showing the relationship between water-cement ratio and strength for each set of trial mix studies. In addition, a curve shall be plotted showing the relationship between 7 day and 28 day strengths. Each mixture shall be designed to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding.

#### 1.6.2 Proportioning Studies for Flexural Strength Concrete

Trial design batches, mixture proportioning studies, and testing requirements shall conform to the requirements specified in paragraph Proportioning Studies for Normal Weight Concrete, except that proportions shall be based on flexural strength as determined by test specimens (beams) fabricated in accordance with ASTM C 192/C 192M and tested in accordance with ASTM C 78. Procedures given in ACI 211.1 shall be modified as necessary to accommodate flexural strength.

#### 1.6.3 Average Compressive Strength Required for Mixtures

The mixture proportions selected during mixture design studies shall produce a required average compressive strength ( $f'_{cr}$ ) exceeding the specified compressive strength ( $f'_c$ ) by the amount indicated below. This required average compressive strength,  $f'_{cr}$ , will not be a required acceptance criteria during concrete production. However, whenever the daily average compressive strength at 28 days drops below  $f'_{cr}$  during concrete production, or daily average 7-day strength drops below a strength correlated with the 28-day  $f'_{cr}$ , the mixture shall be adjusted, as approved, to bring the daily average back up to  $f'_{cr}$ . During production, the required  $f'_{cr}$  shall be adjusted, as appropriate, based on the standard deviation being attained on the job.

#### 1.6.3.1 Computations from Test Records

Where a concrete production facility has test records, a standard deviation shall be established in accordance with the applicable provisions of ACI 214.3R. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths ( $f'_c$ ) within 7 MPa of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days. Required average compressive strength  $f'_{cr}$  used as the basis for selection of concrete proportions shall be the larger of the equations that follow using the standard deviation as determined above:

$$f'_{cr} = f'_c + 1.34S \text{ where units are in MPa}$$

$$f'_{cr} = f'_c + 2.33S - 3.45 \text{ where units are in MPa}$$

Where  $S$  = standard deviation

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, a standard deviation shall be established as the product of the calculated standard deviation and a modification factor from the following table:

NUMBER OF TESTS	MODIFICATION FACTOR FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03
30 or more	1.00

#### 1.6.3.2 Computations without Previous Test Records

When a concrete production facility does not have sufficient field strength

test records for calculation of the standard deviation, the required average strength  $f'_{cr}$  shall be determined as follows:

- a. If the specified compressive strength  $f'_c$  is less than 20 MPa,

$$f'_{cr} = f'_c + 6.9 \text{ MPa}$$

- b. If the specified compressive strength  $f'_c$  is 20 to 35 MPa,

$$f'_{cr} = f'_c + 8.3 \text{ MPa}$$

- c. If the specified compressive strength  $f'_c$  is over 35 MPa,

$$f'_{cr} = f'_c + 9.7 \text{ MPa}$$

#### 1.6.4 Average Flexural Strength Required for Mixtures

The mixture proportions selected during mixture design studies for flexural strength mixtures and the mixture used during concrete production shall be designed and adjusted during concrete production as approved, except that the overdesign for average flexural strength shall simply be 15 percent greater than the specified flexural strength at all times.

### 1.7 STORAGE OF MATERIALS

Cement and other cementitious materials shall be stored in weathertight buildings, bins, or silos which will exclude moisture and contaminants and keep each material completely separated. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Aggregate shall not be stored directly on ground unless a sacrificial layer is left undisturbed. Reinforcing bars and accessories shall be stored above the ground on platforms, skids or other supports. Other materials shall be stored in such a manner as to avoid contamination and deterioration. Admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements. Materials shall be capable of being accurately identified after bundles or containers are opened.

### 1.8 GOVERNMENT ASSURANCE INSPECTION AND TESTING

Day-to day inspection and testing shall be the responsibility of the Contractor Quality Control (CQC) staff. However, representatives of the Contracting Officer can and will inspect construction as considered appropriate and will monitor operations of the Contractor's CQC staff. Government inspection or testing will not relieve the Contractor of any of his CQC responsibilities.

#### 1.8.1 Materials

The Government will sample and test aggregates, cementitious materials, other materials, and concrete to determine compliance with the specifications as considered appropriate. The Contractor shall provide

facilities and labor as may be necessary for procurement of representative test samples. Samples of aggregates will be obtained at the point of batching in accordance with ASTM D 75. Other materials will be sampled from storage at the jobsite or from other locations as considered appropriate. Samples may be placed in storage for later testing when appropriate.

#### 1.8.2 Fresh Concrete

Fresh concrete will be sampled as delivered in accordance with ASTM C 172 and tested in accordance with these specifications, as considered necessary.

#### 1.8.3 Hardened Concrete

Tests on hardened concrete will be performed by the Government when such tests are considered necessary.

#### 1.8.4 Inspection

Concrete operations may be tested and inspected by the Government as the project progresses. Failure to detect defective work or material will not prevent rejection later when a defect is discovered nor will it obligate the Government for final acceptance.

### PART 2 PRODUCTS

#### 2.1 CEMENTITIOUS MATERIALS

Cementitious Materials shall be portland cement, portland blast-furnace slag cement, or portland cement in combination with pozzolan and shall conform to appropriate specifications listed below. Use of cementitious materials in concrete which will have surfaces exposed in the completed structure shall be restricted so there is no change in color, source, or type of cementitious material.

##### 2.1.1 Portland Cement

ASTM C 150, Type I low alkali or Type II low alkali.

##### 2.1.2 High-Early-Strength Portland Cement

ASTM C 150, Type III with tricalcium aluminate limited to 5.8 percent. Type III cement shall be used only in isolated instances and only when approved in writing.

##### 2.1.3 Blended Cements

ASTM C 595M, Type IP.

##### 2.1.4 Pozzolan (Fly Ash)

ASTM C 618, Class C or F with the optional requirements for multiple factor, drying shrinkage, and uniformity from Table 2A of ASTM C 618. Requirement for maximum alkalis from Table 1A of ASTM C 618 shall apply. If pozzolan is used, it shall be 30 percent by weight of the total cementitious material.

## 2.2 AGGREGATES

Aggregates shall conform to the following.

### 2.2.1 Fine Aggregate

Fine aggregate shall conform to the quality and gradation requirements of ASTM C 33.

### 2.2.2 Coarse Aggregate

Coarse aggregate shall conform to ASTM C 33, Class 5S.

## 2.3 CHEMICAL ADMIXTURES

Chemical admixtures, when required or permitted, shall conform to the appropriate specification listed. Admixtures shall be furnished in liquid form and of suitable concentration for easy, accurate control of dispensing.

### 2.3.1 Air-Entraining Admixture

ASTM C 260 and shall consistently entrain the air content in the specified ranges under field conditions.

### 2.3.2 Accelerating Admixture

ASTM C 494, Type C or E, except that calcium chloride or admixtures containing calcium chloride shall not be used.

### 2.3.3 Water-Reducing or Retarding Admixture

ASTM C 494, Type A, B, or D, except that the 6-month and 1-year compressive and flexural strength tests are waived.

### 2.3.4 Surface Retarder

COE CRD-C 94.

### 2.3.5 Other Chemical Admixtures

Chemical admixtures for use in producing flowing concrete shall comply with ASTM C 1017, Type I or II. These admixtures shall be used only when approved in writing, such approval being contingent upon particular mixture control as described in the Contractor's Quality Control Plan and upon performance of separate mixture design studies.

## 2.4 CURING MATERIALS

### 2.4.1 Impervious-Sheet

Impervious-sheet materials shall conform to ASTM C 171, type optional, except, that polyethylene sheet shall not be used.



#### 2.4.2 Membrane-Forming Compound

Membrane-Forming curing compound shall conform to ASTM C 309, Type 1-D or 2, except that only a styrene acrylate or chlorinated rubber compound meeting Class B requirements shall be used for surfaces that are to be painted or are to receive bituminous roofing, or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing, or flooring specified. Nonpigmented compound shall contain a fugitive dye, and shall have the reflective requirements in ASTM C 309 waived.

#### 2.4.3 Burlap and Cotton Mat

Burlap and cotton mat used for curing shall conform to AASHTO M 182.

#### 2.5 WATER

Water for mixing and curing shall be fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water may be used if it meets the requirements of COE CRD-C 400.

#### 2.6 NONSHRINK GROUT

Nonshrink grout shall conform to ASTM C 1107, Grade [A] [B] [C], and shall be a commercial formulation suitable for the proposed application.

#### 2.7 LATEX BONDING AGENT

Latex agents for bonding fresh to hardened concrete shall conform to ASTM C 1059.

#### 2.8 EPOXY RESIN

Epoxy resins for use in repairs shall conform to ASTM C 881, Type V, Grade 2. Class as appropriate to the existing ambient and surface temperatures.

#### 2.9 EMBEDDED ITEMS

Embedded items shall be of the size and type indicated or as needed for the application. Dovetail slots shall be galvanized steel. Inserts for shelf angles and bolt hangers shall be of malleable iron or cast or wrought steel.

#### 2.10 FLOOR HARDENER

Floor hardener shall be a colorless aqueous solution containing zinc silicofluoride, magnesium silicofluoride, or sodium silicofluoride. These silicofluorides can be used individually or in combination. Proprietary hardeners may be used if approved in writing by the Contracting Officer.

#### 2.11 PERIMETER INSULATION

Perimeter insulation shall be polystyrene conforming to ASTM C 578, Type II; polyurethane conforming to ASTM C 591, Type II; or cellular glass conforming

to ASTM C 552, Type I.

## 2.12 VAPOR BARRIER

Vapor barrier shall be polyethylene sheeting with a minimum thickness of 0.15 mm (6 mils) or other equivalent material having a vapor permeance rating not exceeding 30 nanograms per Pascal per second per square meter (0.5 perms) as determined in accordance with ASTM E 96.

## 2.13 JOINT MATERIALS

### 2.13.1 Joint Fillers, Sealers, and Waterstops

Expansion joint fillers shall be preformed materials conforming to ASTM D 1752. Materials for waterstops shall be in accordance with Section 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS. Materials for and sealing of joints shall conform to the requirements of Section 07900 JOINT SEALING 02760 FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS.

### 2.13.2 Contraction Joints in Slabs

Sawable type contraction joint inserts shall conform to COE CRD-C 540. Nonsawable joint inserts shall have sufficient stiffness to permit placement in plastic concrete without undue deviation from a straight line and shall conform to the physical requirements of COE CRD-C 540, with the exception of Section 3.4 "Resistance to Sawing". Plastic inserts shall be polyvinyl chloride conforming to the materials requirements of COE CRD-C 572.

## PART 3 EXECUTION

### 3.1 PREPARATION FOR PLACING

Before commencing concrete placement, the following shall be performed. Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Forms shall be in place, cleaned, coated, and adequately supported, in accordance with Section 03100 STRUCTURAL CONCRETE FORMWORK. Reinforcing steel shall be in place, cleaned, tied, and adequately supported, in accordance with Section 03200 CONCRETE REINFORCEMENT. Transporting and conveying equipment shall be in-place, ready for use, clean, and free of hardened concrete and foreign material. Equipment for consolidating concrete shall be at the placing site and in proper working order. Equipment and material for curing and for protecting concrete from weather or mechanical damage shall be at the placing site, in proper working condition and in sufficient amount for the entire placement. When hot, windy conditions during concreting appear probable, equipment and material shall be at the placing site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete.

#### 3.1.1 Foundations

##### 3.1.1.1 Concrete on Earth Foundations

Earth (subgrade, base, or subbase courses) surfaces upon which concrete is

to be placed shall be clean, damp, and free from debris, frost, ice, and standing or running water. Prior to placement of concrete, the foundation shall be well drained and shall be satisfactorily graded and uniformly compacted.

#### 3.1.1.2 Preparation of Rock

Rock surfaces upon which concrete is to be placed shall be free from oil, standing or running water, ice, mud, drummy rock, coating, debris, and loose, semidetached or unsound fragments. Joints in rock shall be cleaned to a satisfactory depth, as determined by the Contracting Officer, and to firm rock on the sides. Immediately before the concrete is placed, rock surfaces shall be cleaned thoroughly by the use of air-water jets or sandblasting as specified below for Previously Placed Concrete. Rock surfaces shall be kept continuously moist for at least 24 hours immediately prior to placing concrete thereon. All horizontal and approximately horizontal surfaces shall be covered, immediately before the concrete is placed, with a layer of mortar proportioned similar to that in the concrete mixture. Concrete shall be placed before the mortar stiffens.

#### 3.1.1.3 Excavated Surfaces in Lieu of Forms

Concrete for footings and walls may be placed directly against the soil provided the earth or rock has been carefully trimmed, is uniform and stable, and meets the compaction requirements of Section 02315 EXCAVATION, FILLING, AND BACKFILLING FOR BUILDINGS. The concrete shall be placed without becoming contaminated by loose material, and the outline of the concrete shall be within the specified tolerances. 25 mm of concrete shall be added to provide adequate cover, to each earth formed side.

#### 3.1.2 Previously Placed Concrete

##### 3.1.2.1 Preparation of Previously Placed Concrete

Concrete surfaces to which other concrete is to be bonded shall be abraded in an approved manner that will expose sound aggregate uniformly without damaging the concrete. Laitance and loose particles shall be removed. Surfaces shall be thoroughly washed and shall be moist but without free water when concrete is placed.

#### 3.1.3 Vapor Barrier

Vapor barrier shall be provided beneath the interior on-grade concrete floor slabs. The greatest widths and lengths practicable shall be used to eliminate joints wherever possible. Joints shall be lapped a minimum of 300 mm. Torn, punctured, or damaged vapor barrier material shall be removed and new vapor barrier shall be provided prior to placing concrete. For minor repairs, patches may be made using laps of at least 300 mm. Lapped joints shall be sealed and edges patched with pressure-sensitive adhesive or tape not less than 50 mm wide and compatible with the membrane. Vapor barrier shall be placed directly on underlying subgrade, base course, or capillary water barrier, unless it consists of crushed material or large granular material which could puncture the vapor barrier. In this case, the surface shall be choked with a light layer of sand, as approved, before placing the

vapor barrier. A 50 mm layer of compacted, clean concrete sand (fine aggregate) shall be placed on top of the vapor barrier before placing concrete. Concrete placement shall be controlled so as to prevent damage to the vapor barrier, or any covering sand.

#### 3.1.4 Perimeter Insulation

Perimeter insulation shall be installed at locations indicated. Adhesive shall be used where insulation is applied to the interior surface of foundation walls and may be used for exterior application.

#### 3.1.5 Embedded Items

Before placement of concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings, or required. Conduit and other embedded items shall be clean and free of oil and other foreign matter such as loose coatings or rust, paint, and scale. The embedding of wood in concrete will be permitted only when specifically authorized or directed. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable materials to prevent the entry of concrete into voids. Welding shall not be performed on embedded metals within 300 mm of the surface of the concrete. Tack welding shall not be performed on or to embedded items.

### 3.2 CONCRETE PRODUCTION

#### 3.2.1 Batching, Mixing, and Transporting Concrete

Concrete shall either be batched and mixed onsite or shall be furnished from a ready-mixed concrete plant. Ready-mixed concrete shall be batched, mixed, and transported in accordance with ASTM C 94, except as otherwise specified.

Truck mixers, agitators, and nonagitating transporting units shall comply with NRMCA TMMB 100. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA QC 3. Approved batch tickets shall be furnished for each load of ready-mixed concrete. Site-mixed concrete shall conform to the following subparagraphs.

##### 3.2.1.1 General

The batching plant shall be located off site close to the project. The batching, mixing and placing system shall have a capacity of at least 50 cubic meters per hour. The batching plant shall conform to the requirements of NRMCA CPMB 100 and as specified; however, rating plates attached to batch plant equipment are not required.

##### 3.2.1.2 Batching Equipment

The batching controls shall be semiautomatic or automatic, as defined in NRMCA CPMB 100. A semiautomatic batching system shall be provided with interlocks such that the discharge device cannot be actuated until the indicated material is within the applicable tolerance. The batching system shall be equipped with accurate recorder or recorders that meet the requirements of NRMCA CPMB 100. The weight of water and admixtures shall be recorded if batched by weight. Separate bins or compartments shall be

provided for each size group of aggregate and type of cementitious material, to prevent intermingling at any time. Aggregates shall be weighed either in separate weigh batchers with individual scales or, provided the smallest size is batched first, cumulatively in one weigh batcher on one scale. Aggregate shall not be weighed in the same batcher with cementitious material. If both portland cement and other cementitious material are used, they may be batched cumulatively, provided that the portland cement is batched first, . Water may be measured by weight or volume. Water shall not be weighed or measured cumulatively with another ingredient. Filling and discharging valves for the water metering or batching system shall be so interlocked that the discharge valve cannot be opened before the filling valve is fully closed. Piping for water and for admixtures shall be free from leaks and shall be properly valved to prevent backflow or siphoning. Admixtures shall be furnished as a liquid of suitable concentration for easy control of dispensing. An adjustable, accurate, mechanical device for measuring and dispensing each admixture shall be provided. Each admixture dispenser shall be interlocked with the batching and discharging operation of the water so that each admixture is separately batched and individually discharged automatically in a manner to obtain uniform distribution throughout the water as it is added to the batch in the specified mixing period. [When use of truck mixers makes this requirement impractical, the admixture dispensers shall be interlocked with the sand batchers]. Different admixtures shall not be combined prior to introduction in water and shall not be allowed to intermingle until in contact with the cement. Admixture dispensers shall have suitable devices to detect and indicate flow during dispensing or have a means for visual observation. The plant shall be arranged so as to facilitate the inspection of all operations at all times. Suitable facilities shall be provided for obtaining representative samples of aggregates from each bin or compartment, and for sampling and calibrating the dispensing of cementitious material, water, and admixtures. Filling ports for cementitious materials bins or silos shall be clearly marked with a permanent sign stating the contents.

#### 3.2.1.3 Scales

The weighing equipment shall conform to the applicable requirements of CPMB Concrete Plant Standard, and of NIST HB 44, except that the accuracy shall be plus or minus 0.2 percent of scale capacity. The Contractor shall provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring devices.

The tests shall be made at the specified frequency in the presence of a Government inspector. The weighing equipment shall be arranged so that the plant operator can conveniently observe all dials or indicators.

#### 3.2.1.4 Batching Tolerances

##### (A) Tolerances with Weighing Equipment

MATERIAL	PERCENT OF REQUIRED WEIGHT
Cementitious materials	0 to plus 2

MATERIAL	PERCENT OF REQUIRED WEIGHT
Aggregate	plus or minus 2
Water	plus or minus 1
Chemical admixture	0 to plus 6

(B) Tolerances with Volumetric Equipment

For volumetric batching equipment used for water and admixtures, the following tolerances shall apply to the required volume of material being batched:

MATERIAL	PERCENT OF REQUIRED MATERIAL
Water:	plus or minus 1 percent
Chemical admixtures:	0 to plus 6 percent

3.2.1.5 Moisture Control

The plant shall be capable of ready adjustment to compensate for the varying moisture content of the aggregates and to change the weights of the materials being batched.

3.2.1.6 Concrete Mixers

Mixers shall be stationary mixers or truck mixers. Mixers shall be capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. The mixers shall not be charged in excess of the capacity recommended by the manufacturer. The mixers shall be operated at the drum or mixing blade speed designated by the manufacturer. The mixers shall be maintained in satisfactory operating condition, and the mixer drums shall be kept free of hardened concrete. Should any mixer at any time produce unsatisfactory results, its use shall be promptly discontinued until it is repaired.

3.2.1.7 Stationary Mixers

Concrete plant mixers shall be drum-type mixers of tilting, nontilting, horizontal-shaft, or vertical-shaft type, or shall be pug mill type and shall be provided with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed. The mixing time and uniformity shall conform to all the requirements in ASTM C 94 applicable to central-mixed concrete.

3.2.1.8 Truck Mixers

Truck mixers, the mixing of concrete therein, and concrete uniformity shall conform to the requirements of ASTM C 94. A truck mixer may be used either for complete mixing (transit-mixed) or to finish the partial mixing done in a stationary mixer (shrink-mixed). Each truck shall be equipped with two counters from which it is possible to determine the number of revolutions at mixing speed and the number of revolutions at agitating speed. [Or, if

approved in lieu of this, the number of revolutions shall be marked on the batch tickets. Water shall not be added at the placing site unless specifically approved; and in no case shall it exceed the specified w/c. Any such water shall be injected at the base of the mixer, not at the discharge end.

### 3.3 TRANSPORTING CONCRETE TO PROJECT SITE

Concrete shall be transported to the placing site in [truck mixers, [agitators, [nonagitator transporting equipment conforming to NRMCA TMMB 100 or by approved pumping equipment or conveyors. Nonagitator equipment, other than pumps, shall not be used for transporting lightweight aggregate concrete.

### 3.4 CONVEYING CONCRETE ON SITE

Concrete shall be conveyed from mixer or transporting unit to forms as rapidly as possible and within the time interval specified by methods which will prevent segregation or loss of ingredients using following equipment. Conveying equipment shall be cleaned before each placement.

#### 3.4.1 Buckets

The interior hopper slope shall be not less than 58 degrees from the horizontal, the minimum dimension of the clear gate opening shall be at least 5 times the nominal maximum-size aggregate, and the area of the gate opening shall not be less than 0.2 square meters. The maximum dimension of the gate opening shall not be greater than twice the minimum dimension. The bucket gates shall be essentially grout tight when closed and may be manually, pneumatically, or hydraulically operated except that buckets larger than 1.5 cubic meters shall not be manually operated. The design of the bucket shall provide means for positive regulation of the amount and rate of deposit of concrete in each dumping position.

#### 3.4.2 Transfer Hoppers

Concrete may be charged into nonagitator hoppers for transfer to other conveying devices. Transfer hoppers shall be capable of receiving concrete directly from delivery vehicles and shall have conical-shaped discharge features. The transfer hopper shall be equipped with a hydraulically operated gate and with a means of external vibration to effect complete discharge. Concrete shall not be held in nonagitator transfer hoppers more than 30 minutes.

#### 3.4.3 Trucks

Truck mixers operating at agitating speed or truck agitators used for transporting plant-mixed concrete shall conform to the requirements of ASTM C 94. Nonagitator equipment shall be used only for transporting plant-mixed concrete over a smooth road and when the hauling time is less than 15 minutes. Bodies of nonagitator equipment shall be smooth, watertight, metal containers specifically designed to transport concrete, shaped with rounded corners to minimize segregation, and equipped with gates that will permit positive control of the discharge of the concrete.

#### 3.4.4 Chutes

When concrete can be placed directly from a truck mixer, agitator, or nonagitating equipment, the chutes normally attached to this equipment by the manufacturer may be used. A discharge deflector shall be used when required by the Contracting Officer. Separate chutes and other similar equipment will not be permitted for conveying concrete.

#### 3.4.5 Belt Conveyors

Belt conveyors shall be designed and operated to assure a uniform flow of concrete from mixer to final place of deposit without segregation of ingredients or loss of mortar and shall be provided with positive means, such as discharge baffle or hopper, for preventing segregation of the concrete at the transfer points and the point of placing. Belt conveyors shall be constructed such that the idler spacing shall not exceed 900 mm. The belt speed shall be a minimum of 90 meters per minute and a maximum of 225 meters per minute. If concrete is to be placed through installed horizontal or sloping reinforcing bars, the conveyor shall discharge concrete into a pipe or elephant truck that is long enough to extend through the reinforcing bars.

#### 3.4.6 Concrete Pumps

Concrete may be conveyed by positive displacement pump when approved. The pumping equipment shall be piston or squeeze pressure type; pneumatic placing equipment shall not be used. The pipeline shall be rigid steel pipe or heavy-duty flexible hose. The inside diameter of the pipe shall be at least 3 times the nominal maximum-size coarse aggregate in the concrete mixture to be pumped but not less than 100 mm. Aluminum pipe shall not be used.

### 3.5 PLACING CONCRETE

Mixed concrete shall be discharged within 1-1/2 hours or before the mixer drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates. When the concrete temperature exceeds 30 degrees C, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the transporting unit. Concrete shall be handled from mixer or transporting unit to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing and curing. Sufficient placing capacity shall be provided so that concrete can be kept free of cold joints.

#### 3.5.1 Depositing Concrete

Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 1.5 meters except where suitable equipment is provided to prevent segregation and where



specifically authorized. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 300 mm thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be screeded to the proper level. Concrete shall be deposited continuously in one layer or in layers so that fresh concrete is deposited on in-place concrete that is still plastic. Fresh concrete shall not be deposited on concrete that has hardened sufficiently to cause formation of seams or planes of weakness within the section. Concrete that has surface dried, partially hardened, or contains foreign material shall not be used. When temporary spreaders are used in the forms, the spreaders shall be removed as their service becomes unnecessary. Concrete shall not be placed in slabs over columns and walls until concrete in columns and walls has been in-place at least two hours or until the concrete begins to lose its plasticity. Concrete for beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as concrete for adjoining slabs.

### 3.5.2 Consolidation

Immediately after placing, each layer of concrete shall be consolidated by internal vibrators, except for slabs 100 mm thick or less. The vibrators shall at all times be adequate in effectiveness and number to properly consolidate the concrete; a spare vibrator shall be kept at the jobsite during all concrete placing operations. The vibrators shall have a frequency of not less than 10,000 vibrations per minute, an amplitude of at least 0.6 mm, and the head diameter shall be appropriate for the structural member and the concrete mixture being placed. Vibrators shall be inserted vertically at uniform spacing over the area of placement. The distance between insertions shall be approximately 1-1/2 times the radius of action of the vibrator so that the area being vibrated will overlap the adjacent just-vibrated area by a reasonable amount. The vibrator shall penetrate rapidly to the bottom of the layer and at least 150 mm into the preceding layer if there is such. Vibrator shall be held stationary until the concrete is consolidated and then vertically withdrawn slowly while operating. Form vibrators shall not be used unless specifically approved and unless forms are constructed to withstand their use. Vibrators shall not be used to move concrete within the forms. Slabs 100 mm and less in thickness shall be consolidated by properly designed vibrating screeds or other approved technique. Excessive vibration of lightweight concrete resulting in segregation or flotation of coarse aggregate shall be prevented. Frequency and amplitude of vibrators shall be determined in accordance with COE CRD-C 521. Grate tampers ("jitterbugs") shall not be used.

### 3.5.3 Cold Weather Requirements

Special protection measures, approved by the Contracting Officer, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete shall be not less than 5 degrees C. The temperature of the concrete when placed shall be not less than 10 degrees C nor more than 25 degrees C. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be

incorporated in the concrete to prevent freezing. Upon written approval, an accelerating admixture conforming to ASTM C 494, Type C or E may be used, provided it contains no calcium chloride. Calcium chloride shall not be used.

#### 3.5.4 Hot Weather Requirements

When the ambient temperature during concrete placing is expected to exceed 30 degrees C, the concrete shall be placed and finished with procedures previously submitted and as specified herein. The concrete temperature at time of delivery to the forms shall not exceed the temperature shown in the table below when measured in accordance with ASTM C 1064/C 1064M. Cooling of the mixing water or aggregates or placing concrete in the cooler part of the day may be required to obtain an adequate placing temperature. A retarder may be used, as approved, to facilitate placing and finishing. Steel forms and reinforcements shall be cooled as approved prior to concrete placement when steel temperatures are greater than 49 degrees C. Conveying and placing equipment shall be cooled if necessary to maintain proper concrete-placing temperature.

Maximum Allowable Concrete Placing Temperature

Relative Humidity, Percent, During Time of Concrete Placement	Maximum Allowable Concrete Temperature Degrees
Greater than 60	33 C
40-60	30 C
Less than 40	27 C

#### 3.5.5 Prevention of Plastic Shrinkage Cracking

During hot weather with low humidity, and particularly with appreciable wind, as well as interior placements when space heaters produce low humidity, the Contractor shall be alert to the tendency for plastic shrinkage cracks to develop and shall institute measures to prevent this. Particular care shall be taken if plastic shrinkage cracking is potentially imminent and especially if it has developed during a previous placement. Periods of high potential for plastic shrinkage cracking can be anticipated by use of Fig. 2.1.5 of ACI 305R. In addition the concrete placement shall be further protected by erecting shades and windbreaks and by applying fog sprays of water, sprinkling, ponding or wet covering. Plastic shrinkage cracks that occur shall be filled by injection of epoxy resin as directed, after the concrete hardens. Plastic shrinkage cracks shall never be troweled over or filled with slurry.

#### 3.5.6 Placing Concrete Underwater

Concrete shall be deposited in water by a tremie or concrete pump. The methods and equipment used shall be subject to approval. Concrete buckets shall not be used for underwater placement of concrete except to deliver concrete to the tremie. The tremie shall be watertight and sufficiently

large to permit a free flow of concrete. The concrete shall be deposited so that it enters the mass of the previously placed concrete from within, displacing water with a minimum disturbance to the surface of the concrete. The discharge end of the pump line or tremie shaft shall be kept continuously submerged in the concrete. The underwater seal at start of placing shall not produce undue turbulence in the water. The tremie shaft shall be kept full of concrete to a point well above the water surface. Placement shall proceed without interruption until the concrete has been brought to the required height. The tremie shall not be moved horizontally during a placing operation, and a sufficient number of tremies shall be provided so that the maximum horizontal flow of concrete will be limited to 5 m. Concrete shall not be deposited in running water or in water with a temperature below 2 degrees C.

#### 3.5.7 Placing Concrete in Congested Areas

Special care shall be used to ensure complete filling of the forms, elimination of all voids, and complete consolidation of the concrete when placing concrete in areas congested with reinforcing bars, embedded items, waterstops and other tight spacing. An appropriate concrete mixture shall be used, and the nominal maximum size of aggregate (NMSA) shall meet the specified criteria when evaluated for the congested area. Vibrators with heads of a size appropriate for the clearances available shall be used, and the consolidation operation shall be closely supervised to ensure complete and thorough consolidation at all points. Where necessary, splices of reinforcing bars shall be alternated to reduce congestion. Where two mats of closely spaced reinforcing are required, the bars in each mat shall be placed in matching alignment to reduce congestion.

#### 3.5.8 Placing Flowable Concrete

If a plasticizing admixture conforming to ASTM C 1017 is used or if a Type F or G high range water reducing admixture is permitted to increase the slump, the concrete shall meet all requirements of paragraph GENERAL REQUIREMENTS in PART 1. Extreme care shall be used in conveying and placing the concrete to avoid segregation. Consolidation and finishing shall meet all requirements of paragraphs Placing Concrete, Finishing Formed Surfaces, and Finishing Unformed Surfaces. No relaxation of requirements to accommodate flowable concrete will be permitted.

### 3.6 JOINTS

Joints shall be located and constructed as indicated or approved. Joints not indicated on the drawings shall be located and constructed to minimize the impact on the strength of the structure. In general, such joints shall be located near the middle of the spans of supported slabs, beams, and girders unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs, unless otherwise approved. Joints shall be perpendicular to the main reinforcement. All reinforcement shall be continued across joints; except that reinforcement or other fixed metal items shall not be continuous through expansion joints, or through construction or contraction joints in

slabs on grade. Reinforcement shall be 50 mm (2") clear from each joint. Except where otherwise indicated, construction joints between interior slabs on grade and vertical surfaces shall consist of 1.5 kg per square meter asphalt-saturated felt, extending for the full depth of the slab. The perimeters of the slabs shall be free of fins, rough edges, spalling, or other unsightly appearance. Reservoir for sealant for construction and contraction joints in slabs shall be formed to the dimensions shown on the drawings by removing snap-out joint-forming inserts, by sawing sawable inserts, or by sawing to widen the top portion of sawed joints. Joints to be sealed shall be cleaned and sealed as indicated and in accordance with Section 07900 JOINT SEALING.

### 3.6.1 Construction Joints

For concrete other than slabs on grade, construction joints shall be located so that the unit of operation does not exceed 20 meters. Concrete shall be placed continuously so that each unit is monolithic in construction. Fresh concrete shall not be placed against adjacent hardened concrete until it is at least 24 hours old. Construction joints shall be located as indicated or approved. Where concrete work is interrupted by weather, end of work shift or other similar type of delay, location and type of construction joint shall be subject to approval of the Contracting Officer. Unless otherwise indicated and except for slabs on grade, reinforcing steel shall extend through construction joints. Construction joints in slabs on grade shall be keyed or doweled as shown. Concrete columns, walls, or piers shall be in place at least 2 hours, or until the concrete begins to lose its plasticity, before placing concrete for beams, girders, or slabs thereon. In walls having door or window openings, lifts shall terminate at the top and bottom of the opening. Other lifts shall terminate at such levels as to conform to structural requirements or architectural details. Where horizontal construction joints in walls or columns are required, a strip of 25 mm square-edge lumber, bevelled and oiled to facilitate removal, shall be tacked to the inside of the forms at the construction joint. Concrete shall be placed to a point 25 mm above the underside of the strip. The strip shall be removed 1 hour after the concrete has been placed, and any irregularities in the joint line shall be leveled off with a wood float, and all laitance shall be removed. Prior to placing additional concrete, horizontal construction joints shall be prepared as specified in paragraph Previously Placed Concrete.

### 3.6.2 Contraction Joints in Slabs on Grade

Contraction joints shall be located and detailed as shown on the drawings. Contraction Joints shall be produced by forming a weakened plane in the concrete slab by use of rigid inserts impressed in the concrete during placing operations or sawing a continuous slot with a concrete saw. Regardless of method used to produce the weakened plane, it shall be 1/4 the depth of the slab thickness and between 3 and 5 mm wide. For saw-cut joints, cutting shall be timed properly with the set of the concrete. Cutting shall be started as soon as the concrete has hardened sufficiently to prevent ravelling of the edges of the saw cut. Cutting shall be completed before shrinkage stresses become sufficient to produce cracking. Reservoir for joint sealant shall be formed as previously specified.

### 3.6.3 Expansion Joints

Installation of expansion joints and sealing of these joints shall conform to the requirements of Section 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS and Section 07900 JOINT SEALING.

### 3.6.4 Waterstops

Waterstops shall be installed in conformance with the locations and details shown on the drawings using materials and procedures specified in Section 03150 EXPANSION JOINTS, CONTRACTION JOINTS, AND WATERSTOPS.

### 3.6.5 Dowels and Tie Bars

Dowels and tie bars shall be installed at the locations shown on the drawings and to the details shown, using materials and procedures specified in Section 03200 CONCRETE REINFORCEMENT and herein. Conventional smooth "paving" dowels shall be installed in slabs using approved methods to hold the dowel in place during concreting within a maximum alignment tolerance of 1 mm in 100 mm. "Structural" type deformed bar dowels, or tie bars, shall be installed to meet the specified tolerances. Care shall be taken during placing adjacent to and around dowels and tie bars to ensure there is no displacement of the dowel or tie bar and that the concrete completely embeds the dowel or tie bar and is thoroughly consolidated.

## 3.7 FINISHING FORMED SURFACES

Forms, form materials, and form construction are specified in Section 03100 STRUCTURAL CONCRETE FORMWORK. Finishing of formed surfaces shall be as specified herein. Unless another type of architectural or special finish is specified, surfaces shall be left with the texture imparted by the forms except that defective surfaces shall be repaired. Unless painting of surfaces is required, uniform color of the concrete shall be maintained by use of only one mixture without changes in materials or proportions for any structure or portion of structure that requires a Class A or B finish. Except for major defects, as defined hereinafter, surface defects shall be repaired as specified herein within 24 hours after forms are removed. Repairs of the so-called "plaster-type" will not be permitted in any location. Tolerances of formed surfaces shall conform to the requirements of ACI 117/117R. These tolerances apply to the finished concrete surface, not to the forms themselves; forms shall be set true to line and grade. Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter shall be repaired as specified in paragraph Damp-Pack Mortar Repair. Defects whose surface diameter is greater than their depth shall be repaired as specified in paragraph Repair of Major Defects. Repairs shall be finished flush with adjacent surfaces and with the same surface texture. The cement used for all repairs shall be a blend of job cement with white cement proportioned so that the final color after curing and aging will be the same as the adjacent concrete. Concrete with excessive honeycomb, or other defects which affect the strength of the member, will be rejected. Repairs shall be demonstrated to be acceptable and free from cracks or loose or drummy areas at the completion of the contract and, for Class A and B Finishes, shall be inconspicuous. Repairs not meeting these requirements will be rejected and shall be replaced.

### 3.7.1 Class B Finish

Class B finish is required where concrete is exposed to view. Fins, ravelings, and loose material shall be removed, all surface defects over 12 mm in diameter or more than 12 mm deep, shall be repaired and, except as otherwise indicated or as specified in Section 03100 STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Defects more than 12 mm in diameter shall be cut back to sound concrete, but in all cases at least 25 mm deep. The Contractor shall prepare a sample panel for approval (as specified in PART 1) before commencing repair, showing that the surface texture and color match will be attained. Metal tools shall not be used to finish repairs in Class A surfaces.

### 3.7.2 Class C and Class D Finish

Class C finish is required for all concrete not exposed to view. Class D finish is required for foundation surfaces and up against fill. Fins, ravelings, and loose material shall be removed, and, except as otherwise indicated or as specified in Section 03100 STRUCTURAL CONCRETE FORMWORK, holes left by removal of form ties shall be reamed and filled. Honeycomb and other defects more than 12 mm deep or more than 50 mm in diameter shall be repaired. Defects more than 50 mm in diameter shall be cut back to sound concrete, but in all cases at least 25 mm deep.

## 3.8 REPAIRS

### 3.8.1 Damp-Pack Mortar Repair

Form tie holes requiring repair and other defects whose depth is at least as great as their surface diameter but not over 100 mm shall be repaired by the damp-pack mortar method. Form tie holes shall be reamed and other similar defects shall be cut out to sound concrete. The void shall then be thoroughly cleaned, thoroughly wetted, brush-coated with a thin coat of neat cement grout and filled with mortar. Mortar shall be a stiff mix of 1 part portland cement to 2 parts fine aggregate passing the 1.18 mm sieve, and minimum amount of water. Only sufficient water shall be used to produce a mortar which, when used, will stick together on being molded into a ball by a slight pressure of the hands and will not exude water but will leave the hands damp. Mortar shall be mixed and allowed to stand for 30 to 45 minutes before use with remixing performed immediately prior to use. Mortar shall be thoroughly tamped in place in thin layers using a hammer and hardwood block. Holes passing entirely through walls shall be completely filled from the inside face by forcing mortar through to the outside face. All holes shall be packed full. Damp-pack repairs shall be moist cured for at least 48 hours.

### 3.8.2 Repair of Major Defects

Major defects will be considered to be those more than 12 mm deep or, for Class A and B finishes, more than 12 mm in diameter and, for Class C and D finishes, more than 50 mm in diameter. Also included are any defects of any kind whose depth is over 100 mm or whose surface diameter is greater than their depth. Major defects shall be repaired as specified below.

### 3.8.2.1 Surface Application of Mortar Repair

Defective concrete shall be removed, and removal shall extend into completely sound concrete. Approved equipment and procedures which will not cause cracking or microcracking of the sound concrete shall be used. If reinforcement is encountered, concrete shall be removed so as to expose the reinforcement for at least 50 mm on all sides. All such defective areas greater than 7800 square mm shall be outlined by saw cuts at least 25 mm deep. Defective areas less than 7800 square mm shall be outlined by a 25 mm deep cut with a core drill in lieu of sawing. All saw cuts shall be straight lines in a rectangular pattern in line with the formwork panels. After concrete removal, the surface shall be thoroughly cleaned by high pressure washing to remove all loose material. Surfaces shall be kept continually saturated for the first 12 of the 24 hours immediately before placing mortar and shall be damp but not wet at the time of commencing mortar placement. The Contractor, at his option, may use either hand-placed mortar or mortar placed with a mortar gun. If hand-placed mortar is used, the edges of the cut shall be perpendicular to the surface of the concrete. The prepared area shall be brush-coated with a thin coat of neat cement grout. The repair shall then be made using a stiff mortar, preshrunk by allowing the mixed mortar to stand for 30 to 45 minutes and then remixed, thoroughly tamped into place in thin layers. If hand-placed mortar is used, the Contractor shall test each repair area for drumminess by firm tapping with a hammer and shall inspect for cracks, both in the presence of the Contracting Officer's representative, immediately before completion of the contract, and shall replace any showing drumminess or cracking. If mortar placed with a mortar gun is used, the gun shall be a small compressed air-operated gun to which the mortar is slowly hand fed and which applies the mortar to the surface as a high-pressure stream, as approved. Repairs made using shotcrete equipment will not be accepted. The mortar used shall be the same mortar as specified for damp-pack mortar repair. If gun-placed mortar is used, the edges of the cut shall be beveled toward the center at a slope of 1:1. All surface applied mortar repairs shall be continuously moist cured for at least 7 days. Moist curing shall consist of several layers of saturated burlap applied to the surface immediately after placement is complete and covered with polyethylene sheeting, all held closely in place by a sheet of plywood or similar material rigidly braced against it. Burlap shall be kept continually wet.

### 3.8.2.2 Repair of Deep and Large Defects

Deep and large defects will be those that are more than 150 mm deep and also have an average diameter at the surface more than 450 mm or that are otherwise so identified by the Project Office. Such defects shall be repaired as specified herein or directed, except that defects which affect the strength of the structure shall not be repaired and that portion of the structure shall be completely removed and replaced. Deep and large defects shall be repaired by procedures approved in advance including forming and placing special concrete using applied pressure during hardening. Preparation of the repair area shall be as specified for surface application of mortar. In addition, the top edge (surface) of the repair area shall be sloped at approximately 20 degrees from the horizontal, upward toward the side from which concrete will be placed. The special concrete shall be a

concrete mixture with low water content and low slump, and shall be allowed to age 30 to 60 minutes before use. Concrete containing a specified expanding admixture may be used in lieu of the above mixture; the paste portion of such concrete mixture shall be designed to have an expansion between 2.0 and 4.0 percent when tested in accordance with ASTM C 940. A full width "chimney" shall be provided at the top of the form on the placing side to ensure filling to the top of the opening. A pressure cap shall be used on the concrete in the chimney with simultaneous tightening and revibrating the form during hardening to ensure a tight fit for the repair. The form shall be removed after 24 hours and immediately the chimney shall be carefully chipped away to avoid breaking concrete out of the repair; the surface of the repair concrete shall be dressed as required.

### 3.9 FINISHING UNFORMED SURFACES

The finish of all unformed surfaces shall meet the requirements of paragraph Tolerances in PART 1, when tested as specified herein.

#### 3.9.1 General

The ambient temperature of spaces adjacent to unformed surfaces being finished and of the base on which concrete will be placed shall be not less than 10 degrees C. In hot weather all requirements of paragraphs Hot Weather Requirements and Prevention of Plastic Shrinkage Cracking shall be met. Unformed surfaces that are not to be covered by additional concrete or backfill shall have a float finish, with additional finishing as specified below, and shall be true to the elevation shown on the drawings. Surfaces to receive additional concrete or backfill shall be brought to the elevation shown on the drawings, properly consolidated, and left true and regular. Unless otherwise shown on the drawings, exterior surfaces shall be sloped for drainage, as directed. Where drains are provided, interior floors shall be evenly sloped to the drains. Joints shall be carefully made with a jointing or edging tool. The finished surfaces shall be protected from stains or abrasions. Grate tampers or "jitterbugs" shall not be used for any surfaces. The dusting of surfaces with dry cement or other materials or the addition of any water during finishing shall not be permitted. If bleedwater is present prior to finishing, the excess water shall be carefully dragged off or removed by absorption with porous materials such as burlap. During finishing operations, extreme care shall be taken to prevent over finishing or working water into the surface; this can cause "crazing" (surface shrinkage cracks which appear after hardening) of the surface. Any slabs with surfaces which exhibit significant crazing shall be removed and replaced. During finishing operations, surfaces shall be checked with a 10 foot straightedge, applied in both directions at regular intervals while the concrete is still plastic, to detect high or low areas.

#### 3.9.2 Floated Finish

Slabs to receive more than a rough slab finish shall next be given a wood float finish. Areas as indicated on the drawings shall be given only a float finish. The screeding shall be followed immediately by darbying or bull floating before bleeding water is present, to bring the surface to a true, even plane. Then, after the concrete has stiffened so that it will withstand a man's weight without imprint of more than 6 mm and the water



sheen has disappeared, it shall be floated to a true and even plane free of ridges. Floating shall be performed by use of suitable hand floats or power driven equipment. Sufficient pressure shall be used on the floats to bring a film of moisture to the surface. Hand floats shall be made of wood, magnesium, or aluminum. Lightweight concrete or concrete that exhibits stickiness shall be floated with a magnesium float. Care shall be taken to prevent over-finishing or incorporating water into the surface.

### 3.9.3 Troweled Finish

Areas as indicated on the drawings shall be given a trowel finish. After floating is complete and after the surface moisture has disappeared, unformed surfaces shall be steel-troweled to a smooth, even, dense finish, free from blemishes including trowel marks. In lieu of hand finishing, an approved power finishing machine may be used in accordance with the directions of the machine manufacturer. Additional trowelings shall be performed, either by hand or machine until the surface has been troweled 2 times, with waiting period between each. Care shall be taken to prevent blistering and if such occurs, troweling shall immediately be stopped and operations and surfaces corrected. A final hard steel troweling shall be done by hand, with the trowel tipped, and using hard pressure, when the surface is at a point that the trowel will produce a ringing sound. The finished surface shall be thoroughly consolidated and shall be essentially free of trowel marks and be uniform in texture and appearance. The concrete mixture used for troweled finished areas shall be adjusted, if necessary, in order to provide sufficient fines (cementitious material and fine sand) to finish properly.

### 3.10 FLOOR HARDENER

Areas as indicated on the drawings shall be treated with floor hardener. Floor hardener shall be applied after the concrete has been cured and then air dried for 14 to 28 days. Three coats shall be applied, each the day after the preceding coat was applied. For the first application, 0.5 kg of the silicofluoride shall be dissolved in 4 liters of water. For subsequent applications, the solution shall be 1.0 kg of silicofluoride to each 4 liters of water. Floor should be mopped with clear water shortly after the preceding application has dried to remove encrusted salts. Proprietary hardeners shall be applied in accordance with the manufacturer's instructions. During application, area should be well ventilated. Precautions shall be taken when applying silicofluorides due to the toxicity of the salts. Any compound that contacts glass or aluminum should be immediately removed with clear water.

### 3.11 EXTERIOR SLAB AND RELATED ITEMS

#### 3.11.1 Sidewalks

Concrete shall be 100 mm minimum thickness. Contraction joints shall be provided at 1.75 m spaces unless otherwise indicated. Contraction joints shall be cut 25 mm deep with a jointing tool after the surface has been finished. Transverse expansion joints 12 mm thick shall be provided at changes in direction and where sidewalk abuts curbs, steps, rigid pavement, or other similar structures. Sidewalks shall be given a lightly broomed

finish. A transverse slope of 1 mm per 50 mm shall be provided, unless otherwise indicated. Variations in cross section shall be limited to 1 mm per 250 mm.

### 3.11.2 Curbs and Gutters

Concrete shall be formed, placed, and finished by hand using a properly shaped "mule" or constructed using a slipform machine specially designed for this work. Contraction joints shall be cut 75 mm deep with a jointing tool after the surface has been finished. Expansion joints (12 mm wide) shall be provided at 35 m maximum spacing unless otherwise indicated. Exposed surfaces shall be finished using a stiff bristled brush.

### 3.11.3 Pits and Trenches

Pits and trenches shall be constructed as indicated on the drawings. Bottoms and walls shall be placed monolithically or waterstops and keys, shall be provided as approved.

## 3.12 CURING AND PROTECTION

### 3.12.1 General

Concrete shall be cured by an approved method for the period of time given below:

Concrete with Type III cement	3 days
All other concrete	7 days

Immediately after placement, concrete shall be protected from premature drying, extremes in temperatures, rapid temperature change, mechanical injury and damage from rain and flowing water for the duration of the curing period. Air and forms in contact with concrete shall be maintained at a temperature above 10 degrees C for the first 3 days and at a temperature above 0 degrees C for the remainder of the specified curing period. Exhaust fumes from combustion heating units shall be vented to the outside of the enclosure, and heaters and ducts shall be placed and directed so as not to cause areas of overheating and drying of concrete surfaces or to create fire hazards. Materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat, including welding, shall be permitted near or in direct contact with the concrete at any time. Except as otherwise permitted by paragraph Membrane Forming Curing Compounds, moist curing shall be provided for any areas to receive floor hardener, any paint or other applied coating, or to which other concrete is to be bonded. Concrete containing silica fume shall be initially cured by fog misting during finishing, followed immediately by continuous moist curing. Except for plastic coated burlap, impervious sheeting alone shall not be used for curing.

### 3.12.2 Moist Curing

Concrete to be moist-cured shall be maintained continuously wet for the entire curing period, commencing immediately after finishing. If water or curing materials used stain or discolor concrete surfaces which are to be

permanently exposed, the concrete surfaces shall be cleaned as approved. When wooden forms are left in place during curing, they shall be kept wet at all times. If steel forms are used in hot weather, nonsupporting vertical forms shall be broken loose from the concrete soon after the concrete hardens and curing water continually applied in this void. If the forms are removed before the end of the curing period, curing shall be carried out as on unformed surfaces, using suitable materials. Surfaces shall be cured by ponding, by continuous sprinkling, by continuously saturated burlap or cotton mats, or by continuously saturated plastic coated burlap. Burlap and mats shall be clean and free from any contamination and shall be completely saturated before being placed on the concrete. The Contractor shall have an approved work system to ensure that moist curing is continuous 24 hours per day.

### 3.12.3 Membrane Forming Curing Compounds

Membrane curing shall not be used on surfaces that are to receive any subsequent treatment depending on adhesion or bonding to the concrete, including surfaces to which a smooth finish is to be applied or other concrete to be bonded. However, a styrene acrylate or chlorinated rubber compound meeting ASTM C 309, Class B requirements, may be used for surfaces which are to be painted or are to receive bituminous roofing or waterproofing, or floors that are to receive adhesive applications of resilient flooring. The curing compound selected shall be compatible with any subsequent paint, roofing, waterproofing or flooring specified. Membrane curing compound shall not be used on surfaces that are maintained at curing temperatures with free steam. Curing compound shall be applied to formed surfaces immediately after the forms are removed and prior to any patching or other surface treatment except the cleaning of loose sand, mortar, and debris from the surface. All surfaces shall be thoroughly moistened with water. Curing compound shall be applied to slab surfaces as soon as the bleeding water has disappeared, with the tops of joints being temporarily sealed to prevent entry of the compound and to prevent moisture loss during the curing period. The curing compound shall be applied in a two-coat continuous operation by approved motorized power-spraying equipment operating at a minimum pressure of 500 kPa, at a uniform coverage of not more than 10 cubic meters per L for each coat, and the second coat shall be applied perpendicular to the first coat. Concrete surfaces which have been subjected to rainfall within 3 hours after curing compound has been applied shall be resprayed by the method and at the coverage specified. Surfaces on which clear compound is used shall be shaded from direct rays of the sun for the first 3 days. Surfaces coated with curing compound shall be kept free of foot and vehicular traffic, and from other sources of abrasion and contamination during the curing period.

### 3.12.4 Ponding or Immersion

Concrete shall be continually immersed throughout the curing period. Water shall not be more than 10 degrees C less than the temperature of the concrete.

### 3.12.5 Cold Weather Curing and Protection

When the daily ambient low temperature is less than 0 degrees C the

temperature of the concrete shall be maintained above 5 degrees C for the first seven days after placing. During the period of protection removal, the air temperature adjacent to the concrete surfaces shall be controlled so that concrete near the surface will not be subjected to a temperature differential of more than 13 degrees C as determined by suitable temperature measuring devices furnished by [the Government, as required, and installed adjacent to the concrete surface and 50 mm inside the surface of the concrete. The installation of the thermometers shall be made by the Contractor as directed.

### 3.13 SETTING BASE PLATES AND BEARING PLATES

After being properly positioned, column base plates, bearing plates for beams and similar structural members, and machinery and equipment base plates shall be set to the proper line and elevation with damp-pack bedding mortar, except where nonshrink grout is indicated. The thickness of the mortar or grout shall be approximately 1/24 the width of the plate, but not less than 20 mm. Concrete and metal surfaces in contact with grout shall be clean and free of oil and grease, and concrete surfaces in contact with grout shall be damp and free of laitance when grout is placed. Nonshrink grout shall be used under all column base plates.

#### 3.13.1 Damp-Pack Bedding Mortar

Damp-pack bedding mortar shall consist of 1 part cement and 2-1/2 parts fine aggregate having water content such that a mass of mortar tightly squeezed in the hand will retain its shape but will crumble when disturbed. The space between the top of the concrete and bottom of the bearing plate or base shall be packed with the bedding mortar by tamping or ramming with a bar or rod until it is completely filled.

#### 3.13.2 Nonshrink Grout

Nonshrink grout shall be a ready-mixed material requiring only the addition of water. Water content shall be the minimum that will provide a flowable mixture and completely fill the space to be grouted without segregation, bleeding, or reduction of strength.

##### 3.13.2.1 Mixing and Placing of Nonshrink Grout

Mixing and placing shall be in conformance with the material manufacturer's instructions and as specified therein. Ingredients shall be thoroughly dry-mixed before adding water. After adding water, the batch shall be mixed for 3 minutes. Batches shall be of size to allow continuous placement of freshly mixed grout. Grout not used within 30 minutes after mixing shall be discarded. The space between the top of the concrete or machinery-bearing surface and the plate shall be filled solid with the grout. Forms shall be of wood or other equally suitable material for completely retaining the grout on all sides and on top and shall be removed after the grout has set. The placed grout shall be carefully worked by rodding or other means to eliminate voids; however, overworking and breakdown of the initial set shall be avoided. Grout shall not be retempered or subjected to vibration from any source. Where clearances are unusually small, placement shall be under pressure with a grout pump. Temperature of the grout, and of surfaces

receiving the grout, shall be maintained at 18 to 30 degrees C until after setting.

#### 3.13.2.2 Treatment of Exposed Surfaces

For metal-oxidizing nonshrink grout, exposed surfaces shall be cut back 25 mm and immediately covered with a parge coat of mortar consisting of 1 part portland cement and 2-1/2 parts fine aggregate by weight, with sufficient water to make a plastic mixture. The parge coat shall have a smooth finish.

For other mortars or grouts, exposed surfaces shall have a smooth-dense finish and be left untreated. Curing shall comply with paragraph CURING AND PROTECTION.

#### 3.14 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL

The Contractor shall perform the inspection and tests described below and, based upon the results of these inspections and tests, shall take the action required and shall submit specified reports. When, in the opinion of the Contracting Officer, the concreting operation is out of control, concrete placement shall cease and the operation shall be corrected. The laboratory performing the tests shall be onsite and shall conform with ASTM C 1077. Materials may be subjected to check testing by the Government from samples obtained at the manufacturer, at transfer points, or at the project site. The Government will inspect the laboratory, equipment, and test procedures prior to start of concreting operations and at least once per year thereafter for conformance with ASTM C 1077.

##### 3.14.1 Grading and Corrective Action

###### 3.14.1.1 Fine Aggregate

At least once during each shift when the concrete plant is operating, there shall be one sieve analysis and fineness modulus determination in accordance with ASTM C 136 and COE CRD-C 104 for the fine aggregate or for each fine aggregate if it is batched in more than one size or classification. The location at which samples are taken may be selected by the Contractor as the most advantageous for control. However, the Contractor is responsible for delivering fine aggregate to the mixer within specification limits. When the amount passing on any sieve is outside the specification limits, the fine aggregate shall be immediately resampled and retested. If there is another failure on any sieve, the fact shall immediately reported to the Contracting Officer, concreting shall be stopped, and immediate steps taken to correct the grading.

###### 3.14.1.2 Coarse Aggregate

At least once during each shift in which the concrete plant is operating, there shall be a sieve analysis in accordance with ASTM C 136 for each size of coarse aggregate. The location at which samples are taken may be selected by the Contractor as the most advantageous for production control. However, the Contractor shall be responsible for delivering the aggregate to the mixer within specification limits. A test record of samples of aggregate taken at the same locations shall show the results of the current test as well as the average results of the five most recent tests including

the current test. The Contractor may adopt limits for control coarser than the specification limits for samples taken other than as delivered to the mixer to allow for degradation during handling. When the amount passing any sieve is outside the specification limits, the coarse aggregate shall be immediately resampled and retested. If the second sample fails on any sieve, that fact shall be reported to the Contracting Officer. Where two consecutive averages of 5 tests are outside specification limits, the operation shall be considered out of control and shall be reported to the Contracting Officer. Concreting shall be stopped and immediate steps shall be taken to correct the grading.

#### 3.14.2 Quality of Aggregates

Thirty days prior to the start of concrete placement, the Contractor shall perform all tests for aggregate quality required by ASTM C 33. In addition, after the start of concrete placement, the Contractor shall perform tests for aggregate quality at least every three months, and when the source of aggregate or aggregate quality changes. Samples tested after the start of concrete placement shall be taken immediately prior to entering the concrete mixer.

#### 3.14.3 Scales, Batching and Recording

The accuracy of the scales shall be checked by test weights prior to start of concrete operations and at least once every three months. Such tests shall also be made as directed whenever there are variations in properties of the fresh concrete that could result from batching errors. Once a week the accuracy of each batching and recording device shall be checked during a weighing operation by noting and recording the required weight, recorded weight, and the actual weight batched. At the same time, the Contractor shall test and ensure that the devices for dispensing admixtures are operating properly and accurately. When either the weighing accuracy or batching accuracy does not comply with specification requirements, the plant shall not be operated until necessary adjustments or repairs have been made. Discrepancies in recording accuracies shall be corrected immediately.

#### 3.14.4 Batch-Plant Control

The measurement of concrete materials including cementitious materials, each size of aggregate, water, and admixtures shall be continuously controlled. The aggregate weights and amount of added water shall be adjusted as necessary to compensate for free moisture in the aggregates. The amount of air-entraining agent shall be adjusted to control air content within specified limits. A report shall be prepared indicating type and source of cement used, type and source of pozzolan or slag used, amount and source of admixtures used, aggregate source, the required aggregate and water weights per cubic meter, amount of water as free moisture in each size of aggregate, and the batch aggregate and water weights per cubic meter for each class of concrete batched during each day's plant operation.

#### 3.14.5 Concrete Mixture

- a. Air Content Testing. Air content tests shall be made when test specimens are fabricated. In addition, at least two tests for air

- content shall be made on randomly selected batches of each separate concrete mixture produced during each 8-hour period of concrete production. Additional tests shall be made when excessive variation in workability is reported by the placing foreman or Government inspector. Tests shall be made in accordance with ASTM C 231 for normal weight concrete and ASTM C 173 for lightweight concrete. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single test result reaches either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the air content of the batch to plot on both the air content and the control chart for range, and for determining need for any remedial action. The result of each test, or average as noted in the previous sentence, shall be plotted on a separate control chart for each mixture on which an "average line" is set at the midpoint of the specified air content range from paragraph Air Entrainment. An upper warning limit and a lower warning limit line shall be set 1.0 percentage point above and below the average line, respectively. An upper action limit and a lower action limit line shall be set 1.5 percentage points above and below the average line, respectively. The range between each two consecutive tests shall be plotted on a secondary control chart for range where an upper warning limit is set at 2.0 percentage points and an upper action limit is set at 3.0 percentage points. Samples for air content may be taken at the mixer, however, the Contractor is responsible for delivering the concrete to the placement site at the stipulated air content. If the Contractor's materials or transportation methods cause air content loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the air content at the mixer controlled as directed.
- b. Air Content Corrective Action. Whenever points on the control chart for percent air reach either warning limit, an adjustment shall immediately be made in the amount of air-entraining admixture batched. As soon as practical after each adjustment, another test shall be made to verify the result of the adjustment. Whenever a point on the secondary control chart for range reaches the warning limit, the admixture dispenser shall be recalibrated to ensure that it is operating accurately and with good reproducibility. Whenever a point on either control chart reaches an action limit line, the air content shall be considered out of control and the concreting operation shall immediately be halted until the air content is under control. Additional air content tests shall be made when concreting is restarted.
- c. Slump Testing. In addition to slump tests which shall be made when test specimens are fabricated, at least four slump tests shall be made on randomly selected batches in accordance with ASTM C 143 for each separate concrete mixture produced during each 8-hour or less period of concrete production each day. Also, additional tests shall be made when excessive variation in workability is reported by

- the placing foreman or Government inspector. Test results shall be plotted on control charts which shall at all times be readily available to the Government and shall be submitted weekly. Copies of the current control charts shall be kept in the field by testing crews and results plotted as tests are made. When a single slump test reaches or goes beyond either the upper or lower action limit, a second test shall immediately be made. The results of the two tests shall be averaged and this average used as the slump of the batch to plot on both the control charts for slump and the chart for range, and for determining need for any remedial action. Limits shall be set on separate control charts for slump for each type of mixture. The upper warning limit shall be set at 12.5 mm below the maximum allowable slump specified in paragraph Slump in PART 1 for each type of concrete and an upper action limit line and lower action limit line shall be set at the maximum and minimum allowable slumps, respectively, as specified in the same paragraph. The range between each consecutive slump test for each type of mixture shall be plotted on a single control chart for range on which an upper action limit is set at 50 mm. Samples for slump shall be taken at the mixer. However, the Contractor is responsible for delivering the concrete to the placement site at the stipulated slump. If the Contractor's materials or transportation methods cause slump loss between the mixer and the placement, correlation samples shall be taken at the placement site as required by the Contracting Officer, and the slump at the mixer controlled as directed.
- d. Slump Corrective Action. Whenever points on the control charts for slump reach the upper warning limit, an adjustment shall immediately be made in the batch weights of water and fine aggregate. The adjustments are to be made so that the total water content does not exceed that amount allowed by the maximum w/c ratio specified, based on aggregates which are in a saturated surface dry condition. When a single slump reaches the upper or lower action limit, no further concrete shall be delivered to the placing site until proper adjustments have been made. Immediately after each adjustment, another test shall be made to verify the correctness of the adjustment. Whenever two consecutive individual slump tests, made during a period when there was no adjustment of batch weights, produce a point on the control chart for range at or above the upper action limit, the concreting operation shall immediately be halted, and the Contractor shall take appropriate steps to bring the slump under control. Additional slump tests shall be made as directed.
- e. Temperature. The temperature of the concrete shall be measured when compressive strength specimens are fabricated. Measurement shall be in accordance with ASTM C 1064/C 1064M. The temperature shall be reported along with the compressive strength data.
- f. Strength Specimens. At least one set of test specimens shall be made, for compressive or flexural strength as appropriate, on each different concrete mixture placed during the day for each 380 cubic meters or portion thereof of that concrete mixture placed each day. Additional sets of test specimens shall be made, as directed by the Contracting Officer, when the mixture proportions are changed or



when low strengths have been detected. A truly random (not haphazard) sampling plan shall be developed by the Contractor and approved by the Contracting Officer prior to the start of construction. The plan shall assure that sampling is done in a completely random and unbiased manner. A set of test specimens for concrete with a 28-day specified strength per paragraph Strength Requirements in PART 1 shall consist of four specimens, two to be tested at 7 days and two at 28 days. [A set of test specimens for concrete with a 90-day strength per the same paragraph shall consist of six specimens, two tested at 7 days, two at 28 days, and two at 90 days. Test specimens shall be molded and cured in accordance with ASTM C 31/C 31M and tested in accordance with ASTM C 39 for test cylinders and ASTM C 78 for test beams. Results of all strength tests shall be reported immediately to the Contracting Officer. Quality control charts shall be kept for individual strength "tests", ("test" as defined in paragraph Strength Requirements in PART 1) moving average of last 3 "tests" for strength, and moving average for range for the last 3 "tests" for each mixture. The charts shall be similar to those found in ACI 214.3R.

#### 3.14.6 Inspection Before Placing

Foundations, construction joints, forms, and embedded items shall be inspected by the Contractor in sufficient time prior to each concrete placement in order to certify to the Contracting Officer that they are ready to receive concrete. The results of each inspection shall be reported in writing.

#### 3.14.7 Placing

The placing foreman shall supervise placing operations, shall determine that the correct quality of concrete or grout is placed in each location as specified and as directed by the Contracting Officer, and shall be responsible for measuring and recording concrete temperatures and ambient temperature hourly during placing operations, weather conditions, time of placement, volume placed, and method of placement. The placing foreman shall not permit batching and placing to begin until it has been verified that an adequate number of vibrators in working order and with competent operators are available. Placing shall not be continued if any pile of concrete is inadequately consolidated. If any batch of concrete fails to meet the temperature requirements, immediate steps shall be taken to improve temperature controls.

#### 3.14.8 Vibrators

The frequency and amplitude of each vibrator shall be determined in accordance with COE CRD-C 521 prior to initial use and at least once a month when concrete is being placed. Additional tests shall be made as directed when a vibrator does not appear to be adequately consolidating the concrete.

The frequency shall be determined while the vibrator is operating in concrete with the tachometer being held against the upper end of the vibrator head while almost submerged and just before the vibrator is withdrawn from the concrete. The amplitude shall be determined with the

head vibrating in air. Two measurements shall be taken, one near the tip and another near the upper end of the vibrator head, and these results averaged. The make, model, type, and size of the vibrator and frequency and amplitude results shall be reported in writing. Any vibrator not meeting the requirements of paragraph Consolidation, shall be immediately removed from service and repaired or replaced.

#### 3.14.9 Curing Inspection

- a. Moist Curing Inspections. At least once each shift, and not less than twice per day on both work and non-work days, an inspection shall be made of all areas subject to moist curing. The surface moisture condition shall be noted and recorded.
- b. Moist Curing Corrective Action. When a daily inspection report lists an area of inadequate curing, immediate corrective action shall be taken, and the required curing period for those areas shall be extended by 1 day.
- c. Membrane Curing Inspection. No curing compound shall be applied until the Contractor has verified that the compound is properly mixed and ready for spraying. At the end of each operation, the Contractor shall estimate the quantity of compound used by measurement of the container and the area of concrete surface covered, shall compute the rate of coverage in square meters per Liter, and shall note whether or not coverage is uniform.
- d. Membrane Curing Corrective Action. When the coverage rate of the curing compound is less than that specified or when the coverage is not uniform, the entire surface shall be sprayed again.
- e. Sheet Curing Inspection. At least once each shift and once per day on non-work days, an inspection shall be made of all areas being cured using impervious sheets. The condition of the covering and the tightness of the laps and tapes shall be noted and recorded.
- f. Sheet Curing Corrective Action. When a daily inspection report lists any tears, holes, or laps or joints that are not completely closed, the tears and holes shall promptly be repaired or the sheets replaced, the joints closed, and the required curing period for those areas shall be extended by 1 day.

#### 3.14.10 Cold-Weather Protection

At least once each shift and once per day on non-work days, an inspection shall be made of all areas subject to cold-weather protection. Any deficiencies shall be noted, corrected, and reported.

#### 3.14.11 Mixer Uniformity

- a. Stationary Mixers. Prior to the start of concrete placing and once every 6 months when concrete is being placed, or once for every 60,000 cubic meters of concrete placed, whichever results in the shortest time interval, uniformity of concrete mixing shall be

determined in accordance with ASTM C 94.

- b. Truck Mixers. Prior to the start of concrete placing and at least once every 6 months when concrete is being placed, uniformity of concrete mixing shall be determined in accordance with ASTM C 94. The truck mixers shall be selected randomly for testing. When satisfactory performance is found in one truck mixer, the performance of mixers of substantially the same design and condition of the blades may be regarded as satisfactory.
- c. Mixer Uniformity Corrective Action. When a mixer fails to meet mixer uniformity requirements, either the mixing time shall be increased, batching sequence changed, batch size reduced, or adjustments shall be made to the mixer until compliance is achieved.

#### 3.14.12 Reports

All results of tests or inspections conducted shall be reported informally as they are completed and in writing daily. A weekly report shall be prepared for the updating of control charts covering the entire period from the start of the construction season through the current week. During periods of cold-weather protection, reports of pertinent temperatures shall be made daily. These requirements do not relieve the Contractor of the obligation to report certain failures immediately as required in preceding paragraphs. Such reports of failures and the action taken shall be confirmed in writing in the routine reports. The Contracting Officer has the right to examine all contractor quality control records.

-- End of Section --

## SECTION 03415

PRECAST-PRESTRESSED CONCRETE  
**01/96**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ACI INTERNATIONAL (ACI)

- |              |   |
|--------------|---|
| ACI 211.1    | (1991) Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete |
| ACI 214      | (1977; R 1989) Recommended Practice for Evaluation of Strength Test Results of Concrete       |
| ACI 318/318R | (1995) Building Code Requirements for Structural Concrete and Commentary                      |

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- |                 |   |
|-----------------|---|
| ASTM C 31/C 31M | (1996) Making and Curing Concrete Test Specimens in the Field   |
| ASTM C 33       | (1993) Concrete Aggregates  |
| ASTM C 39       | (1996) Compressive Strength of Cylindrical Concrete Specimens   |
| ASTM C 150      | (1997) Portland Cement  |
| ASTM C 172      | (1990) Sampling Freshly Mixed Concrete  |
| ASTM C 231      | (1997) Air Content of Freshly Mixed Concrete by the Pressure Method   |
| ASTM C 260      | (1995) Air-Entraining Admixtures for Concrete   |
| ASTM C 311      | (1997) Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete |
| ASTM C 430      | (1994) Standard Test Method for Fineness of Hydraulic Cement by the 45-Micrometer (No.                              |

	325) Sieve
ASTM C 494	(1992) Chemical Admixtures for Concrete
ASTM C 595	(1994a) Blended Hydraulic Cements
ASTM C 618	(1997) Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 1069	(1986; R 1992) Specific Surface Area of Alumina or Quartz by Nitrogen Adsorption

#### PRECAST/PRESTRESSED CONCRETE INSTITUTE (PCI)

PCI Mn1-116s	(1985) Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products
PCI Mn1-120	(1992) PCI Design Handbook - Precast and Prestressed Concrete

### 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-02 Shop Drawings

##### Erection; GA-AO

The Contractor shall prepare and submit for approval complete shop drawings that show the precast unit manufacturer's recommended details and materials for the work required by paragraphs DELIVERY, STORAGE, AND HANDLING and ERECTION. The shop drawings shall include: design computations; marking of the units for the placing drawings; anchorages for work of other trades; anchorages to support construction; size and location of steel tendons; methods of stressing; location and sizes of all openings 300 mm wide or larger to be cast into members; formwork; joints between units and other construction; reinforcing steel details; method of curing; and, pickup points and lifting devices.

#### SD-03 Product Data

#### Erection Plan

The Contractor shall prepare a detailed erection plan which shall be submitted at least 15 days prior to the date that erection of members is to begin.

#### Design Calculations

Design calculations shall be submitted prior to the initiation of manufacture of members to be used under this contract.

#### Concrete Mixture Proportions

Concrete mixture proportions shall be submitted for approval.

#### Construction Records

Construction records of the manufacturing, handling, and erection of the precast prestressed concrete members shall be submitted.

#### SD-06 Test Reports

##### Concrete; GA-AO

The results of concrete strength testing by the contractor shall be submitted not more than 5 days after the tests are completed.

### 1.3 SYSTEM DESCRIPTION

#### 1.3.1 Design Requirements

##### 1.3.1.1 Precast-Prestressed Members and Connections

Design of members and connections shall be in accordance with ACI 318/318R and PCI Mn1-120.

##### 1.3.1.2 Loads

Loadings for members and connections shall include all dead load, live load, applicable lateral loads such as wind and earthquake, applicable construction loads such as handling, erection loads, and other applicable loads.

##### 1.3.1.3 Design Calculations

Design calculations for members and connections shall be made by a registered professional engineer experienced in the design of precast-prestressed concrete.

#### 1.3.2 Performance Requirements

Perform the following testing to ensure the materials and method used meet the requirements of these specifications and will produce precast-prestressed concrete members which are suitable for their intended use.

#### 1.3.2.1 Concrete

Concrete shall be sampled and cylinders made in accordance with ASTM C 172 and ASTM C 31/C 31M.

a. Concrete Test Cylinders. A minimum of two concrete test cylinders per bed shall be made to verify the strength of concrete at the time of stress transfer and a minimum of two test cylinders per day or 38 cubic meters of concrete or fraction thereof, whichever results in the most cylinders, shall be made for each mix design to verify the attainment of the specified strength.

b. Cylinder Making. Cylinders shall be made as near as possible to the location where they will be cured and shall not be disturbed in any way from 1/2 hour after casting until they are either 24 hours old or ready to be tested. Concrete in cylinders may be consolidated by rodding or by vibration as specified in ASTM C 31/C 31M.

c. Cylinder Curing

(1) Test cylinders shall be cured with similar methods as the members they represent. In lieu of actual curing with the members, cylinders may be cured in curing chambers correlated in temperature and humidity with the beds. In such a case, the correlation shall be constantly verified by use of recording thermometers in the curing chambers and comparison with the temperature records of beds and by use of the same methods of moisture retention for curing chambers and casting beds.

(2) For beds cured by steam or radiant heat, cylinders shall be placed at random points along the bed. If there is any indication of variable heat, cylinders shall be placed in the coolest area.

(3) Test cylinders to indicate compliance with specified 28-day or earlier strength shall remain in the bed with the member until the member is removed. At that time, the cylinders shall be removed from their molds and placed in storage in a moist condition at 23 degrees plus or minus 1.5 degrees C.

d. Testing of Cylinders

(1) Testing of cylinders to determine compressive strength shall be performed in accordance with ASTM C 39. The strength of concrete at any given age shall be determined as the average of two cylinders, except a single cylinder test can be used to determine stress transfer strength or predictive strengths at less than 28 days.

(2) Testing machines shall be calibrated in accordance with ASTM C 39.

#### 1.3.2.2 Air Content

The air content tests shall be conducted in accordance with ASTM C 231. At

least one air content test shall be conducted on the concrete from which each member is cast.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

##### 1.4.1 Transportation

###### 1.4.1.1 Transporting Members

In transporting members by truck, railroad car, or barge, provision shall be made for supporting the members as described above, except battens can be continuous over more than one stack of units, with adequate bracing to ensure their maintaining the vertical position and damping of dangerous vibrations. Trucks with double bolsters are satisfactory provided the members are fully seated on the outer bolsters at not more than 1 m or the depth of the member from the end and the inner bolster is not more than 2.3 m from the end of the member or the designated pickup point. Adequate padding material shall be provided between tie chains or cables to preclude chipping of concrete.

###### 1.4.1.2 Lateral Deflection or Vibration

Any noticeable indication of lateral deflection or vibration during transportation shall be corrected by rigid bracing between members or by means of lateral trussing.

##### 1.4.2 Storage

###### 1.4.2.1 Storage Areas

Storage areas for prestressed members shall be stabilized, and suitable foundations shall be provided, so differential settlement or twisting of members will not occur.

###### 1.4.2.2 Stacked members

Stacked members shall be separated and supported by battens placed across the full width of each bearing point. Battens shall be arranged in vertical planes at a distance not greater than the depth of the member from designated pickup points. Battens shall not be continuous over more than one stack of precast units. Stacking of members shall be such that lifting devices will be accessible and undamaged. The upper members of a stacked tier shall not be used as storage areas for shorter members or equipment.

##### 1.4.3 Handling of Members

The location of pickup points for handling of the members and details of the pickup devices shall be shown in shop drawings. Members shall be handled only by means of approved devices at designated locations. Members shall be maintained in an upright position at all times and picked up and supported as shown in approved shop drawings.

## PART 2 PRODUCTS



## 2.1 MATERIALS

Materials shall comply with the following:

### 2.1.1 Cement

Cement shall comply with the following:

#### 2.1.1.1 Portland Cement

Portland cement shall conform to ASTM C 150, Type I.

#### 2.1.1.2 Blended Hydraulic Cement

Blended hydraulic cement shall conform to ASTM C 595 Type IS.

### 2.1.2 Pozzolan

Pozzolan shall conform to ASTM C 618 Class F or C.

### 2.1.3 Other Materials

#### 2.1.3.1 Aggregates

Aggregates shall meet the requirements of ASTM C 33.

#### 2.1.3.2 Admixtures

In no event shall admixtures containing chlorides or nitrates be used in the concrete.

a. Air-entraining admixture shall be certified to comply with ASTM C 260.

b. Water-reducing admixture shall be certified to comply with ASTM C 494 Type A.

c. Accelerating admixture shall be certified to comply with ASTM C 494 Type C.

### 2.1.4 Steel Reinforcement

Steel reinforcement shall be in accordance with Section 03201 STEEL BARS AND WELDED WIRE FABRIC FOR CONCRETE REINFORCEMENT.

### 2.1.5 Steel Tendons

Steel tendons shall be in accordance with Section 03230 STEEL STRESSING TENDONS AND ACCESSORIES FOR PRESTRESSED CONCRETE.

## 2.2 CONCRETE MIXTURE PROPORTIONS

### 2.2.1 Concrete

Concrete shall be composed of cementitious material, water, fine and coarse

aggregate, and admixtures. The cementitious material shall be portland or blended hydraulic cement and pozzolan where appropriate. The admixtures shall be an air-entraining agent and may include a water-reducing admixture when its formulation and use are approved.

### 2.2.2 Proportions

The concrete mixture proportions shall meet the following requirements:

Specified Strength = [\_\_\_\_\_] MPa at 28 days.

Air Content = 5 to 7 percent as determined in accordance with ASTM C 231. Proportions shall be selected so that the maximum permitted w/c ratio is not exceeded and so as to produce an average strength exceeding the design strength  $f'_c$  by the amount indicated below. Where the production facility has a standard deviation record determined in accordance with ACI 214, based on 30 consecutive strength tests of similar mixture proportions to that proposed, obtained within 1 year of the time when concrete placing is expected, it shall be used in selecting average strength. The average strength used as the basis for selecting proportions shall exceed the specified strength  $f'_c$  by at least.

2.8 MPa if standard deviation is less than 2.1 MPa  
3.8 MPa if standard deviation is 2.1 to 2.8 MPa  
4.8 MPa if standard deviation is 2.8 to 3.4 MPa  
6.2 MPa if standard deviation is 3.4 to 4.1 MPa

If the standard deviation exceeds 4.1 MPa or if a standard deviation record is not available, proportions shall be selected to produce an average strength at least 8.3 MPa greater than the specified strength.

Mixtures shall be proportioned in accordance with ACI 211.1. The trial mixtures shall be formulated using the same materials as those to be used in the units supplied under this specification, and the selected proportions shall be submitted for approval with the results of cylinder strengths at 28 days.

## 2.3 EVALUATION AND ACCEPTANCE

### 2.3.1 Concrete

A test result shall be the average of the strengths of the two test cylinders made in accordance with paragraph SYSTEM DESCRIPTION, subparagraph PERFORMANCE REQUIREMENTS, subparagraph CONCRETE, subparagraph "a", CONCRETE TEST CYLINDERS. The strength level of the concrete will be considered satisfactory if the average of all sets of three consecutive strength tests equal or exceed the specified strength  $f'_c$  and no individual test falls below the specified value by more than 3.4 MPa. Members manufactured with concrete that does not meet the strength requirements shall be rejected.

#### 2.3.1.1 Air Content

All members cast with concrete having a measured air content less than 5 percent shall be rejected. Members cast with concrete having an air content up to 9 percent may be incorporated into the work if the strength requirements are met.

### 2.3.2 Tolerances

The precast-prestressed members shall be manufactured within the following tolerances. Members failing to meet the dimensional tolerances shall be rejected.

#### 2.3.2.1 Length of Member

The length of the member shall not deviate from the length shown in the contract drawings by more than plus or minus 19 mm or plus or minus 1 mm per m of length, whichever is greater.

#### 2.3.2.2 Cross-sectional Dimensions

The cross-sectional dimensions of a member, if less than 900 mm, shall not vary by more than plus or minus 6 mm and, if over 900 mm, they shall not vary by more than plus or minus 9 mm.

#### 2.3.2.3 Horizontal Alignment (Sweep)

The horizontal alignment of the members shall not deviate from a straight line parallel to the theoretical centerline by more than 13 mm or 1 mm per m of length, whichever is greater. The maximum gap between two adjacent members due to sweep shall not exceed 25 mm.

#### 2.3.2.4 Camber

The actual camber of beams shall not deviate from the computed camber by more than plus or minus 1 mm per m but not more than plus or minus 1/2 inch maximum total deviation.

#### 2.3.2.5 Camber Differential

The differential in camber at midspan between adjacent members shall not exceed 2 mm per m of length or maximum. The differential in camber at midspan between adjacent members shall not exceed 1 mm per m of length or 19 mm maximum.

#### 2.3.2.6 Position of Tendons

The position of the tendons shall not deviate from the design position by more than plus or minus 6 mm.

#### 2.3.2.7 Handling Devices

The actual position of handling devices shall not deviate from the designed position by more than plus or minus 150 mm.

#### 2.3.2.8 Anchors and Inserts

The actual position of anchors and inserts shall not vary by more than plus or minus 25 mm from positions shown in the contract drawings.

#### 2.3.2.9 Flange Thickness

The thickness of a flange or slab shall not vary from the dimensions in the drawings by more than plus 6 mm or minus 3 mm.

#### 2.3.2.10 Depth of Member at Support

At the supports, the depth of a member shall not deviate from the dimensions shown in the contract drawings by more than plus or minus 6 mm.

#### 2.3.2.11 Distance Between Stems

The actual distance between stems shall not deviate from the dimension shown in the contract drawing by more than plus or minus 3 mm.

#### 2.3.2.12 Squareness of Ends

The ends of members shall not deviate from being square by more than plus or minus 6 mm. Squareness shall be checked in both the vertical and horizontal planes.

### 2.3.3 Defects

#### 2.3.3.1 Minor Defects

Minor defects are those which involve less than 900 mm. of concrete and do not expose stressing tendons or reinforcing steel. These defects will be repaired as specified hereinafter. Cracks which are visible but are 250  $\mu$ m wide or less will be accepted.

#### 2.3.3.2 Major Defects

Major defects are those which involve more than 900 mm. of concrete or expose stressing tendons or reinforcing steel. If one or more major defects appear in a member, it shall be rejected. Cracks of a width of more than 250  $\mu$ m shall be cause for rejection of the member.

## PART 3 EXECUTION

### 3.1 FABRICATION

Fabrication of precast-prestressed members shall follow the applicable provisions of the PCI Mnl-116s, except as specified herein.

### 3.2 BEDS AND FORMS

#### 3.2.1 Casting Beds

All casting beds shall have concrete support on unyielding foundations.

#### 3.2.2 Forms

Forms, both fixed and movable, shall be of steel. All forms and beds shall be thoroughly cleaned after each use.

### 3.2.3 Bulkheads

Bulkheads, spacers, templates, and similar equipment having influence on the accuracy of dimensions and alignment shall be regularly inspected and maintained after each casting.

### 3.2.4 Alignment

Accurate alignment of forms shall be maintained during the casting operation to assure compliances with tolerances specified in paragraph EVALUATION AND ACCEPTANCE. Leakage of the paste in form joints is not acceptable, and measures shall be taken to prevent such leakage. Measures shall also be taken to provide corner chamfers.

### 3.2.5 Form Ties

For exposed members, form ties, if used, shall be of the threaded or snap-off type so no parts will be left at the surface of the finished concrete.

## 3.3 TENDONS

The tendons shall be placed, stressed, and destressed in accordance with Section 03230 STEEL STRESSING TENDONS AND ACCESSORIES FOR PRESTRESSED CONCRETE.

## 3.4 ANCHORAGES FOR POSTTENSIONING

Anchorage for posttensioning tendons will not interfere with the placement of the member such that adequate compaction of the concrete in the anchorage zone is impeded.

## 3.5 STEEL REINFORCEMENT

Steel bars and welded wire fabric shall be placed in accordance with Section 03201 STEEL BARS AND WELDED WIRE FABRIC FOR CONCRETE REINFORCEMENT.

## 3.6 CONCRETE PLACEMENT

Concrete placement shall be in accordance with Section 03301 CAST-IN-PLACE STRUCTURAL CONCRETE, except that once placement is started in a member it shall be carried on in a continuous operation until the member is completed.

Members shall be cast in a horizontal position and casting in tiers will not be permitted. Adequate vibration shall be provided with internal and form vibrators so the cast members shall be free of rock pockets or surface blemishes resulting from inadequate vibration. Cold joints shall not be permitted in prestressed concrete members. If delays occur that result in hardening of the concrete so it will not receive a vibrator and again become plastic, the concrete shall be removed and the forms shall be washed out and refilled, otherwise partially cast members will be rejected.

### 3.7 CURING AND PROTECTION

Concrete for the manufacturing of the precast-prestressed concrete members shall be cured and protected in accordance with Section 03301 CAST-IN-PLACE STRUCTURAL CONCRETE or by other methods further specified here.

#### 3.7.1 Curing with Steam at Atmospheric Pressure

Steam curing shall be under a suitable enclosure to retain the live steam to minimize moisture and heat losses. The enclosure shall allow free circulation of the steam around the sides and top of the beams. Steam jets shall be so positioned so they do not discharge directly on the concrete, forms, or test cylinders. The cycle of steam application shall conform to the following:

##### 3.7.1.1 Curing After Placing and Vibrating

After placing and vibrating, the concrete shall be allowed to attain its initial set before the steam is applied. During the period between placement of the concrete and application of steam, provisions shall be made to prevent surface drying by means of a coating of membrane curing compound, moist covers, or equally effective methods. Application of the steam shall be delayed not less than 2 hours and not more than 10 hours after the time of concrete placement. If the ambient temperature is below [\_\_\_\_\_] degrees C, enough heat shall be applied to maintain the concrete at its placing temperature.

##### 3.7.1.2 Temperature Increase

The ambient temperature within the casting enclosure shall be increased at a rate not to exceed 22 degrees C per hour. Temperature increase shall be as uniform as possible.

##### 3.7.1.3 Temperature Range

The temperature shall be increased until the ambient temperature in the casting enclosure is between 60 and 71 degrees C. Once this temperature range is reached, it shall be maintained until the concrete has reached the compressive strength necessary for stressing or destressing the tendons.

##### 3.7.1.4 Temperature Decrease

In discontinuing the steam curing, the ambient air temperature shall decrease at a rate not to exceed 22 degrees C per hour. Temperature decrease shall be as uniform as possible.

##### 3.7.1.5 Recording Thermometers

Recording thermometers showing the time-temperature relationship through the curing period from placing concrete to transfer of prestress shall be provided. At least one recording thermometer per casting enclosure shall be used. The desired curing time-temperature relationship shall be placed on the recording chart of the recording thermometer to aid the personnel

controlling the temperature during curing. Recording charts shall be made available upon request and shall be clearly visible during the curing process.

### 3.7.2 Curing with Radiant Heat and Moisture

#### 3.7.2.1 Radiant Heat

Radiant heat may be applied to beds by means of pipe circulating steam, hot oil, or hot water or by electric blankets or heating elements on forms. Pipes, blankets, or elements shall not be in contact with concrete, form surface, or test cylinders.

#### 3.7.2.2 Moisture Loss

During the cycle of radiant heat curing, effective means shall be provided to prevent rapid loss of moisture in any part of the member. Moisture may be applied by a covering of moist burlap or cotton matting. Moisture may be retained by covering the member with a plastic sheet in combination with an insulating cover or by applying a liquid seal coat or membrane curing compound.

#### 3.7.2.3 Temperature Limits

Temperature limits and use of recording thermometer shall be as specified for curing with steam at atmospheric pressure.

#### 3.7.2.4 Termination of Curing

Termination of curing shall be as specified in Section 03301 CAST-IN-PLACE STRUCTURAL CONCRETE unless the concrete has been cured by one of the two methods stated above. Termination of curing for concrete cured by either the steam at atmospheric pressure method or the radiant heat with moisture shall be determined based on the compressive strength of the concrete necessary for stressing or destressing the tendons.

### 3.8 REPAIRS

All honeycombed areas, chipped corners, air pockets over 6 mm in diameter, and other minor defects shall be repaired. Form offsets of fins over 3 mm shall be ground smooth. All unsound concrete shall be removed from defective areas prior to repairing. All surfaces permanently exposed to view shall be repaired by a blend of portland cement and white cement properly proportioned so that the final color when cured will be the same as adjacent concrete.

### 3.9 FINISHING

#### 3.9.1 Unformed surfaces

Unformed surfaces shall receive a steel trowel finish.

#### 3.9.2 Formed Surfaces

Formed surfaces shall match the texture and color of the sample panels, paragraph PRECAST PANEL.

### 3.10 ERECTION

Erection shall comply with the following.

#### 3.10.1 Storage Provisions

All provisions for storage and handling given in paragraph DELIVERY, STORAGE, AND HANDLING shall be observed at the erection site.

#### 3.10.2 Seating of Precast Prestressed Concrete Members

The precast prestressed concrete members shall be set into place in a manner which assures full bearing. If the bearing called for in the contract drawing is not obtained, then the members shall be removed and the situation corrected.

#### 3.10.3 Roof and Floor

Roof and floor single or double T-beams shall be erected in an increasing or decreasing magnitude of camber to minimize differential between beams. The contractor shall measure T-beam camber and number the beams prior to erection.

#### 3.10.4 Welding

Welding during erection shall be done in accordance with Section 05055 METALWORK FABRICATION, MACHINE WORK AND MISCELLANEOUS PROVISIONS. When welding or burning with a welding electrode, the ground shall be attached directly to the base metal. Under no circumstances shall the member be used as a conductor for the ground.

#### 3.10.5 Erection Plan

The erection plan shall be in sufficient detail so that adequacy of equipment, techniques, and accessories can be determined and comments offered. Acceptance of the Contractor's erection plan shall not relieve the Contractor of his responsibility for erecting precast prestressed members into position as required by the plans and specifications.

### 3.11 CONSTRUCTION RECORDS

Complete construction records shall be kept of the manufacturing, handling, and erection of the precast-prestressed concrete members. Records shall be kept for, but not limited to, the following items:

- a. Specifications of material used in the manufacture of the members.
- b. Time-temperature history of the concrete members from casting to the transfer of the prestress force.
- c. Records of the tendon stressing operation including initial



prestress force, measured elongation, how it was measured, and how the tendons were stressed and destressed.

d. Records of inspection of the members before and after the prestress force is transferred to the members.

e. Records of the inspection of the members each time they are moved.

f. Records of any defects in the member and any corrective measures taken.

-- End of Section --

DIVISION 4 – MASONRY

04200	Masonry
04220	Nonbearing Masonry Veneer/Steel Stud Walls

## SECTION 04200

MASONRY  
07/92

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ACI INTERNATIONAL (ACI)

ACI SP-66 (1994) ACI Detailing Manual

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 82	(1997a) Steel Wire, Plain, for Concrete Reinforcement
ASTM A 153/A 153M	(1998) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 615/A 615M	(1996a) Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 55	(1999) Concrete Brick
ASTM C 62	(1999) Building Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C 67	(1999a) Sampling and Testing Brick and Structural Clay Tile
ASTM C 90	(1999a) Loadbearing Concrete Masonry Units
ASTM C 91	(1999) Masonry Cement
ASTM C 126	(1999) Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units
ASTM C 129	(1999a) Nonloadbearing Concrete Masonry Units
ASTM C 140	(1999b) Sampling and Testing Concrete Masonry Units
ASTM C 216	(1999) Facing Brick (Solid Masonry Units Made from Clay or Shale)

ASTM C 270	(1999b) Mortar for Unit Masonry
ASTM C 476	(1999) Grout for Masonry
ASTM C 494/C 494M	(1999a) Chemical Admixtures for Concrete
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 641	(1982; R 1998el) Staining Materials in Lightweight Concrete Aggregates
ASTM C 652	(1997) Hollow Brick (Hollow Masonry Units Made From Clay or Shale)
ASTM C 744	(1999) Prefaced Concrete and Calcium Silicate Masonry Units
ASTM C 780	(1996el) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C 1019	(1989a; R 1999) Sampling and Testing Grout
ASTM C 1072	(1999) Measurement of Masonry Flexural Bond Strength
ASTM C 1289	(1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D 2000	(1999) Rubber Products in Automotive Applications
ASTM D 2240	(1997el) Rubber Property - Durometer Hardness
ASTM D 2287	(1996a) Nonrigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
ASTM E 119	(1998) Fire Tests of Building Construction and Materials
ASTM E 447	(1997) Compressive Strength of Masonry Prisms

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Masonry Work; GA-RE.

Drawings including plans, elevations, and details of wall reinforcement; details of reinforcing bars at corners and wall intersections; offsets; tops, bottoms, and ends of walls; control and expansion joints; and wall openings. Bar splice locations shall be shown. If the Contractor opts to furnish inch-pound CMU products, drawings showing elevation of walls exposed to view and indicating the location of all cut CMU products shall be submitted for approval. Bent bars shall be identified on a bending diagram and shall be referenced and located on the drawings. Wall dimensions, bar clearances, and wall openings greater than one masonry unit in area shall be shown. No approval will be given to the shop drawings until the Contractor certifies that all openings, including those for mechanical and electrical service, are shown. If, during construction, additional masonry openings are required, the approved shop drawings shall be resubmitted with the additional openings shown along with the proposed changes. Location of these additional openings shall be clearly highlighted. The minimum scale for wall elevations shall be 1 to 50. Reinforcement bending details shall conform to the requirements of ACI SP-66.

#### SD-03 Product Data

Clay or Shale Brick; GA-RE Insulation; G.

Manufacturer's descriptive data.

#### SD-04 Samples

Concrete Masonry Units (CMU); GA-RE. Stone Items; GA-RE. Clay or Shale Brick; GA-RE.

Color samples of three stretcher units and one unit for each type of special shape. Units shall show the full range of color and texture.

Anchors, Ties, and Bar Positioners; GA-RE.

Two of each type used.

Expansion-Joint Material; GA-RE.

One piece of each type used.

Joint Reinforcement; GA-RE.

One piece of each type used, including corner and wall intersection pieces, showing at least two cross wires.

Insulation; GA-RE.

One piece of board type insulation, not less than 400 mm by 600 mm in size, containing the label indicating the rated permeance and R-values.

Portable Panel; GA-RE.

One panel of clay or shale brick, 600 mm by 600 mm, containing approximately 24 brick facings to establish range of color and texture.

#### SD-06 Test Reports

Efflorescence Test; GA-RE. Field Testing of Mortar; GA-RE. Field Testing of Grout; GA-RE. Prism tests; GA-RE. Masonry Cement; GA-RE.

Test reports from an approved independent laboratory. Test reports on a previously tested material shall be certified as the same as that proposed for use in this project.

Special Inspection; G.

Copies of masonry inspector reports.

#### SD-07 Certificates

Clay or Shale Brick, Concrete Masonry Units (CMU) Control Joint Keys Anchors, Ties, and Bar Positioners Expansion-Joint Materials Joint Reinforcement Reinforcing Steel Bars and Rods Masonry Cement Mortar Coloring Insulation Precast Concrete Items Mortar Admixtures Grout Admixtures

Certificates of compliance stating that the materials meet the specified requirements.

Insulation; GA-RE.

Certificate attesting that the polyurethane or polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

#### SD-08 Manufacturer's Instructions

Cold Weather Installation; G.

Cold weather construction procedures.

### 1.3 SAMPLE MASONRY PANELS

After material samples are approved and prior to starting masonry work, sample masonry panels shall be constructed for each type and color of masonry required. At least 48 hours prior to constructing the sample panel or panels, the Contractor shall submit written notification to the Contracting Officer's Representative. Sample panels shall not be built in, or as part of the structure, but shall be located where directed.

#### 1.3.1 Configuration

Panels shall be L-shaped or otherwise configured to represent all of the

wall elements. Panels shall be of the size necessary to demonstrate the acceptable level of workmanship for each type of masonry represented on the project. The minimum size of a straight panel or a leg of an L-shaped panel shall be 2.5 m by 1.2.

#### 1.3.2 Composition

Panels shall show full color range, texture, and bond pattern of the masonry work. The Contractor's method for mortar joint tooling; grouting of reinforced vertical cores, collar joints, bond beams, and lintels; positioning, securing, and lapping of reinforcing steel; positioning and lapping of joint reinforcement (including prefabricated corners); and cleaning of masonry work shall be demonstrated during the construction of the panels. Installation or application procedures for anchors, wall ties, CMU control joints, brick expansion joints, insulation, flashing, brick soldier, row lock courses and weep holes shall be shown in the sample panels. The panels shall contain a masonry bonded corner that includes a bond beam corner.

#### 1.3.3 Construction Method

Where anchored veneer walls are required, the Contractor shall demonstrate and receive approval for the method of construction; i.e., either bring up the two wythes together or separately, with the insulation and appropriate ties placed within the specified tolerances across the cavity. Temporary provisions shall be demonstrated to preclude mortar or grout droppings in the cavity and to provide a clear open air space of the dimensions shown on the drawings. Where masonry is to be grouted, the Contractor shall demonstrate and receive approval on the method that will be used to bring up the masonry wythes; support the reinforcing bars; and grout cells, bond beams, lintels, and collar joints using the requirements specified herein. If sealer is specified to be applied to the masonry units, sealer shall be applied to the sample panels. Panels shall be built on a properly designed concrete foundation.

#### 1.3.4 Usage

The completed panels shall be used as the standard of workmanship for the type of masonry represented. Masonry work shall not commence until the sample panel for that type of masonry construction has been completed and approved. Panels shall be protected from the weather and construction operations until the masonry work has been completed and approved. After completion of the work, the sample panels, including all foundation concrete, shall become the property of the Contractor and shall be removed from the construction site.

### 1.4 DELIVERY, HANDLING, AND STORAGE

Materials shall be delivered, handled, stored, and protected to avoid chipping, breakage, and contact with soil or contaminating material.

#### 1.4.1 Masonry Units

Concrete masonry units shall be covered or protected from inclement weather

and shall conform to the moisture content as specified in ASTM C 90 when delivered to the jobsite. Prefabricated lintels shall be marked on top sides to show either the lintel schedule number or the number and size of top and bottom bars.

#### 1.4.2 Reinforcement, Anchors, and Ties

Steel reinforcing bars, coated anchors, ties, and joint reinforcement shall be stored above the ground. Steel reinforcing bars and uncoated ties shall be free of loose mill scale and rust.

#### 1.4.3 Cementitious Materials, Sand and Aggregates

Cementitious and other packaged materials shall be delivered in unopened containers, plainly marked and labeled with manufacturers' names and brands. Cementitious material shall be stored in dry, weathertight enclosures or be completely covered. Cement shall be handled in a manner that will prevent the inclusion of foreign materials and damage by water or dampness. Sand and aggregates shall be stored in a manner to prevent contamination or segregation.

## PART 2 PRODUCTS

### 2.1 GENERAL REQUIREMENTS

The source of materials which will affect the appearance of the finished work shall not be changed after the work has started except with Contracting Officer's approval. The Contractor has the option to use either hard metric or substitute inch-pound (soft-metric) CMU products. If the Contractor decides to substitute inch-pound CMU products, the following additional requirements shall be met:

- a. The metric dimensions indicated on the drawings shall not be altered to accommodate inch-pound CMU products either horizontally or vertically. The 100 mm building module shall be maintained, except for the CMU products themselves.
- b. Mortar joint widths shall be maintained as specified.
- c. Rebars shall not be cut, bent or eliminated to fit into the inch-pound CMU products module.
- d. Brick and inch-pound CMU products shall not be reduced in size by more than one-third ( $1/3$ ) in height and one-half ( $1/2$ ) in length. Cut CMU products shall not be located at ends of walls, corners, and other openings.
- e. Cut, exposed brick and CMU products shall be held to a minimum and located where they would have the least impact on the architectural aesthetic goals of the facility.
- f. Other building components, built into the CMU products, such as window frames, door frames, louvers, grilles, fire dampers, etc., that are required to be metric, shall remain metric.



g. Additional metric guidance shall conform to Section 01415 METRIC MEASUREMENTS.

## 2.2 CLAY OR SHALE BRICK

Color range and texture of clay or shale brick shall be as indicated and shall conform to the approved sample. Grade SW or MW shall be used in brickwork. Brick shall be tested for efflorescence. Clay or shale brick units shall be delivered factory-blended to provide a uniform appearance and color range in the completed wall.

### 2.2.1 Solid Clay or Shale Brick

Solid clay or shale brick shall conform to ASTM C 216, Type FBS. Brick size shall be modular and the nominal size of the brick used shall be 68 mm thick, 92 mm wide, and 194 mm long. Minimum compressive strength of the brick shall be [\_\_\_\_\_] MPa

## 2.3 CONCRETE MASONRY UNITS (CMU)

Hollow and solid concrete masonry units shall conform to ASTM C 90, Type I. Cement shall have a low alkali content and be of one brand.

### 2.3.1 Aggregates

Lightweight aggregates and blends of lightweight and heavier aggregates in proportions used in producing the units, shall comply with the following requirements when tested for stain-producing iron compounds in accordance with ASTM C 641: by visual classification method, the iron stain deposited on the filter paper shall not exceed the "light stain" classification.

### 2.3.2 Kinds and Shapes

Units shall be modular in size and shall include closer, jamb, header, lintel, and bond beam units and special shapes and sizes to complete the work as indicated. In exposed interior masonry surfaces, units having a bullnose shall be used for vertical external corners except at door, window, and louver jambs. Radius of the bullnose shall be 25 mm. Units used in exposed masonry surfaces in any one building shall have a uniform fine to medium texture and a uniform color.

#### 2.3.2.1 Architectural Units

Units shall have patterned face shell. Face shell pattern shall be split ribbed] face. Units shall be integrally colored during manufacture. Color shall be as shown in Color Schedule. Patterned face shell shall be properly aligned in the completed wall.

## 2.4 PRECAST CONCRETE ITEMS

Splashblocks window sills shall be factory-made units from a plant regularly engaged in producing precast concrete units. Unless otherwise indicated, concrete shall be 28 MPa minimum conforming to Section 03300 CAST-IN-PLACE

STRUCTURAL CONCRETE using 13 mm to No. 4 nominal-size coarse aggregate, and minimum reinforcement shall be the reinforcement required for handling of the units. Clearance of 20 mm shall be maintained between reinforcement and faces of units. Unless precast-concrete items have been subjected during manufacture to saturated-steam pressure of at least 827 kPa for at least 5 hours, the items, after casting, shall be either damp-cured for 24 hours or steam-cured and shall then be aged under cover for 28 days or longer. Cast-concrete members weighing over 35 kg shall have built-in loops of galvanized wire or other approved provisions for lifting and anchoring. Units shall have beds and joints at right angles to the face, with sharp true arises and shall be cast with drip grooves on the underside where units overhang walls. Exposed-to-view surfaces shall be free of surface voids, spalls, cracks, and chipped or broken edges. Precast units exposed-to-view shall be of uniform appearance and color. Unless otherwise specified, units shall have a smooth dense finish. Prior to use, each item shall be wetted and inspected for crazing. Items showing evidence of dusting, spalling, crazing, or having surfaces treated with a protective coating will be rejected.

#### 2.4.1 Sills

Sills shall be cast with washes. Sills for windows having mullions shall be cast in sections with head joints at mullions and a 6 mm allowance for mortar joints. The ends of sills, except a 20 mm wide margin at exposed surfaces, shall be roughened for bond.

#### 2.4.2 Splash Blocks

Splash blocks shall be as detailed. Reinforcement shall be the manufacturer's standard.

### 2.5 MORTAR

Mortar shall be Type S in accordance with the proportion specification of ASTM C 270 except Type S cement-lime mortar proportions shall be 1 part cement, 1/2 part lime and 4-1/2 parts aggregate; when masonry cement ASTM C 91 is used the maximum air content shall be limited to 12 percent and performance equal to cement-lime mortar shall be verified. Verification of masonry cement performance shall be based on ASTM C 780 and ASTM C 1072. Mortar for prefaced concrete masonry unit wainscots shall contain aggregates with 100 percent passing the 2.36 mm sieve and 95 percent passing the 1.18 mm sieve. Pointing mortar in showers and kitchens shall contain ammonium stearate, or aluminum tri-stearate, or calcium stearate in an amount equal to 3 percent by weight of cement used. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

#### 2.5.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494/C 494M, Type C.

### 2.6 GROUT

Grout shall conform to ASTM C 476. Cement used in grout shall have a low alkali content. Grout slump shall be between 200 and 250 mm. Grout shall be used subject to the limitations of Table III. Proportions shall not be changed and materials with different physical or chemical characteristics shall not be used in grout for the work unless additional evidence is furnished that the grout meets the specified requirements.

#### 2.6.1 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixture shall be non-corrosive, shall contain less than 0.2 percent chlorides, and shall conform to ASTM C 494/C 494M, Type C.

#### 2.7 ANCHORS, TIES, AND BAR POSITIONERS

Anchors and ties shall be fabricated without drips or crimps and shall be zinc-coated in accordance with ASTM A 153/A 153M, Class B-2. Steel wire used for anchors and ties shall be fabricated from steel wire conforming to ASTM A 82. Anchors and ties shall be sized to provide a minimum of 16 mm mortar cover from either face.

##### 2.7.1 Wall Ties

Wall ties shall be rectangular-shaped or Z-shaped fabricated of 5 mm diameter zinc-coated steel wire. Rectangular wall ties shall be no less than 100 mm wide. Wall ties may also be of a continuous type conforming to paragraph JOINT REINFORCEMENT. Adjustable type wall ties, if approved for use, shall consist of two essentially U-shaped elements fabricated of 5 mm diameter zinc-coated steel wire. Adjustable ties shall be of the double pintle to eye type and shall allow a maximum of 13 mm eccentricity between each element of the tie. Play between pintle and eye opening shall be not more than 2 mm. The pintle and eye elements shall be formed so that both can be in the same plane.

##### 2.7.2 Dovetail Anchors

Dovetail anchors shall be of the flexible wire type, 5 mm diameter zinc-coated steel wire, triangular shaped, and attached to a 12 gauge or heavier steel dovetail section. These anchors shall be used for anchorage of veneer wythes or composite-wall facings extending over the face of concrete columns, beams, or walls. Cells within vertical planes of these anchors shall be filled solid with grout for full height of walls or partitions, or solid units may be used. Dovetail slots are specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

##### 2.7.3 Bar Positioners

Bar positioners, used to prevent displacement of reinforcing bars during the course of construction, shall be factory fabricated from 9 gauge steel wire or equivalent, and coated with a hot-dip galvanized finish. Not more than one wire shall cross the cell.

## 2.8 JOINT REINFORCEMENT

Joint reinforcement shall be factory fabricated from steel wire conforming to ASTM A 82, welded construction. Tack welding will not be acceptable in reinforcement used for wall ties. Wire shall have zinc coating conforming to ASTM A 153/A 153M, Class B-2. All wires shall be a minimum of 9 gauge. Reinforcement shall be ladder type design, having one longitudinal wire in the mortar bed of each face shell for hollow units and one wire for solid units. Joint reinforcement shall be placed a minimum of 16 mm cover from either face. The distance between crosswires shall not exceed 400 mm. Joint reinforcement for straight runs shall be furnished in flat sections not less than 3 m long. Joint reinforcement shall be provided with factory formed corners and intersections. If approved for use, joint reinforcement may be furnished with adjustable wall tie features.

## 2.9 REINFORCING STEEL BARS AND RODS

Reinforcing steel bars and rods shall conform to ASTM A 615/A 615M, Grade 60.

## 2.10 EXPANSION-JOINT MATERIALS

Backer rod and sealant shall be adequate to accommodate joint compression equal to 50 percent of the width of the joint. The backer rod shall be compressible rod stock of polyethylene foam, polyurethane foam, butyl rubber foam, or other flexible, nonabsorptive material as recommended by the sealant manufacturer. Sealant shall conform to Section 07900 JOINT SEALING.

# PART 3 EXECUTION

## 3.1 ENVIRONMENTAL REQUIREMENTS

### 3.1.1 Hot Weather Installation

The following precautions shall be taken if masonry is erected when the ambient air temperature is more than 37 degrees C in the shade and the relative humidity is less than 50 percent. All masonry materials shall be shaded from direct sunlight; mortar beds shall be spread no more than 1.2 m ahead of masonry; masonry units shall be set within one minute of spreading mortar; and after erection, masonry shall be protected from direct exposure to wind and sun for 48 hours.

### 3.1.2 Cold Weather Installation

Before erecting masonry when ambient temperature or mean daily air temperature falls below 4 degrees C, a written statement of proposed cold weather construction procedures shall be submitted for approval. The following precautions shall be taken during all cold weather erection.

#### 3.1.2.1 Preparation

Ice or snow formed on the masonry bed shall be thawed by the application of heat. Heat shall be applied carefully until the top surface of the masonry is dry to the touch. Sections of masonry deemed frozen and damaged shall be removed before continuing construction of those sections.

- a. Air Temperature 4 to 0 degrees C. Sand or mixing water shall be heated to produce mortar temperatures between 4 degrees C and 49 degrees C.
- b. Air Temperature 0 to minus 4 degrees C. Sand and mixing water shall be heated to produce mortar temperatures between 4 degrees C and 49 degrees C. Temperature of mortar on boards shall be maintained above freezing.
- c. Air Temperature minus 4 to minus 7 degrees C. Sand and mixing water shall be heated to provide mortar temperatures between 4 degrees C and 49 degrees C. Temperature of mortar on boards shall be maintained above freezing. Sources of heat shall be used on both sides of walls under construction. Windbreaks shall be employed when wind is in excess of 24 km/hour.
- d. Air Temperature minus 7 degrees C and below. Sand and mixing water shall be heated to provide mortar temperatures between 4 degrees C and 49 degrees C. Enclosure and auxiliary heat shall be provided to maintain air temperature above 0 degrees C. Temperature of units when laid shall not be less than minus 7 degrees C.

#### 3.1.2.2 Completed Masonry and Masonry Not Being Worked On

- a. Mean daily air temperature 4 degrees C to 0 degrees C. Masonry shall be protected from rain or snow for 24 hours by covering with weather-resistive membrane.
- b. Mean daily air temperature 0 degrees C to minus 4 degrees C. Masonry shall be completely covered with weather-resistant membrane for 24 hours.
- c. Mean Daily Air Temperature minus 4 degrees C to minus 7 degrees C. Masonry shall be completely covered with insulating blankets or equally protected for 24 hours.
- d. Mean Daily Temperature minus 7 degrees C and Below. Masonry temperature shall be maintained above 0 degrees C for 24 hours by enclosure and supplementary heat, by electric heating blankets, infrared heat lamps, or other approved methods.

### 3.2 LAYING MASONRY UNITS

Masonry units shall be laid in running bond pattern. Facing courses shall be level with back-up courses, unless the use of adjustable ties has been approved in which case the tolerances shall be plus or minus 13 mm. Each unit shall be adjusted to its final position while mortar is still soft and plastic. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned, and relaid with fresh mortar. Air spaces, cavities, chases, expansion joints, and spaces to be grouted shall be kept free from mortar and other debris. Units used in exposed masonry surfaces shall be selected from those having the least amount of chipped edges or other imperfections detracting from the appearance of the finished work.

Vertical joints shall be kept plumb. Units being laid and surfaces to receive units shall be free of water film and frost. Solid units shall be laid in a nonfurrowed full bed of mortar. Mortar for veneer wythes shall be beveled and sloped toward the center of the wythe from the cavity side. Units shall be shoved into place so that the vertical joints are tight. Vertical joints of brick and the vertical face shells of concrete masonry units, except where indicated at control, expansion, and isolation joints, shall be completely filled with mortar. Mortar will be permitted to protrude up to 13 mm into the space or cells to be grouted. Means shall be provided to prevent mortar from dropping into the space below. In double wythe construction, the inner wythe may be brought up not more than 400 mm ahead of the outer wythe. Collar joints shall be filled with mortar or grout during the laying of the facing wythe, and filling shall not lag the laying of the facing wythe by more than 200 mm.

#### 3.2.1 Surface Preparation

Surfaces upon which masonry is placed shall be cleaned of laitance, dust, dirt, oil, organic matter, or other foreign materials and shall be slightly roughened to provide a surface texture with a depth of at least 3 mm. Sandblasting shall be used, if necessary, to remove laitance from pores and to expose the aggregate.

#### 3.2.2 Forms and Shores

Forms and shores shall be sufficiently rigid to prevent deflections which may result in cracking or other damage to supported masonry and sufficiently tight to prevent leakage of mortar and grout. Supporting forms and shores shall not be removed in less than 10 days.

#### 3.2.3 Concrete Masonry Units

Units in piers, pilasters, columns, starting courses on footings, solid foundation walls, lintels, and beams, and where cells are to be filled with grout shall be full bedded in mortar under both face shells and webs. Other units shall be full bedded under both face shells. Head joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell. Foundation walls below grade shall be grouted solid. Jamb units shall be of the shapes and sizes to conform with wall units. Solid units may be incorporated in the masonry work where necessary to fill out at corners, gable slopes, and elsewhere as approved. Double walls shall be stiffened at wall-mounted plumbing fixtures by use of strap anchors, two above each fixture and two below each fixture, located to avoid pipe runs, and extending from center to center of the double wall. Walls and partitions shall be adequately reinforced for support of wall-hung plumbing fixtures when chair carriers are not specified.

#### 3.2.4 Tolerances

Masonry shall be laid plumb, true to line, with courses level. Bond pattern shall be kept plumb throughout. Corners shall be square unless noted otherwise. Except for walls constructed of prefaced concrete masonry units, masonry shall be laid within the following tolerances (plus or minus unless otherwise noted):

TABLE II  
TOLERANCES

Variation from the plumb in the lines  
and surfaces of columns, walls and arises

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In adjacent masonry units	3 mm
In 3 m	6 mm
In 6 m	10 mm
In 12 m or more	13 mm

Variations from the plumb for external corners,  
expansion joints, and other conspicuous lines

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### 3.2.5 Cutting and Fitting

Full units of the proper size shall be used wherever possible, in lieu of cut units. Cutting and fitting, including that required to accommodate the work of others, shall be done by masonry mechanics using power masonry saws.

Concrete masonry units may be wet or dry cut. Wet cut units, before being placed in the work, shall be dried to the same surface-dry appearance as uncut units being laid in the wall. Cut edges shall be clean, true and sharp. Openings in the masonry shall be made carefully so that wall plates, cover plates or escutcheons required by the installation will completely conceal the openings and will have bottoms parallel with the masonry bed joints. Reinforced masonry lintels shall be provided above openings over 300 mm wide for pipes, ducts, cable trays, and other wall penetrations, unless steel sleeves are used.

### 3.2.6 Jointing

Joints shall be tooled when the mortar is thumbprint hard. Horizontal joints shall be tooled last. Joints shall be brushed to remove all loose and excess mortar. Mortar joints shall be finished as follows:

#### 3.2.6.1 Door and Window Frame Joints

On the exposed interior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 10 mm. On the exterior side of exterior frames, joints between frames and abutting masonry walls shall be raked to a depth of 10 mm.

### 3.2.7 Joint Widths

Joint widths shall be as follows:

#### 3.2.7.1 Concrete Masonry Units

Concrete masonry units shall have 10 mm joints, except for prefaced concrete masonry units.

### 3.2.8 Embedded Items

Spaces around built-in items shall be filled with mortar. Openings around flush-mount electrical outlet boxes in wet locations shall be pointed with mortar. Anchors, ties, wall plugs, accessories, flashing, pipe sleeves and other items required to be built-in shall be embedded as the masonry work progresses. Anchors, ties and joint reinforcement shall be fully embedded in the mortar. Cells receiving anchor bolts and cells of the first course below bearing plates shall be filled with grout.

### 3.2.9 Unfinished Work

Unfinished work shall be stepped back for joining with new work. Toothing may be resorted to only when specifically approved. Loose mortar shall be removed and the exposed joints shall be thoroughly cleaned before laying new work.

### 3.2.10 Masonry Wall Intersections

Each course shall be masonry bonded at corners and elsewhere as shown. Masonry walls shall be anchored or tied together at corners and intersections with bond beam reinforcement and prefabricated corner or tee pieces of joint reinforcement as shown.

### 3.2.11 Partitions

Partitions shall be continuous from floor to underside of floor or roof deck where shown. Openings in firewalls around joists or other structural members shall be filled as indicated or approved. Where suspended ceilings on both sides of partitions are indicated, the partitions other than those shown to be continuous may be stopped approximately 100 mm above the ceiling level. An isolation joint shall be placed in the intersection between partitions and structural or exterior walls as shown. Interior partitions having 100 mm nominal thick units shall be tied to intersecting partitions of 100 mm units, 125 mm into partitions of 150 mm units, and 175 into partitions of 200 mm or thicker units. Cells within vertical plane of ties shall be filled solid with grout for full height of partition or solid masonry units may be used. Interior partitions having masonry walls over 100 mm thick shall be tied together with joint reinforcement. Partitions containing joint reinforcement shall be provided with prefabricated pieces at corners and intersections or partitions.

## 3.3 ANCHORED VENEER CONSTRUCTION

The inner and outer wythes shall be completely separated by a continuous airspace as shown on the drawings. Both the inner and the outer wythes shall be laid up together except when adjustable joint reinforcement assemblies are approved for use. When both wythes are not brought up together, through-wall flashings shall be protected from damage until they are fully enclosed in the wall. The airspace between the wythes shall be kept clear and free of mortar droppings by temporary wood strips laid on the wall ties and carefully lifted out before placing the next row of ties. A coarse gravel or drainage material shall be placed behind the weep holes in



the cavity to a minimum depth of 100 mm of coarse aggregate or 250 mm of drainage material to keep mortar droppings from plugging the weep holes.

### 3.4 COMPOSITE WALLS

Masonry wythes shall be tied together with joint reinforcement or with unit wall ties. Facing shall be anchored to concrete backing with wire dovetail anchors set in slots built in the face of the concrete as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. The facing wythe shall be anchored or tied to the backup at a maximum spacing of 400 mm on center vertically and 600 mm on center horizontally. Unit ties shall be spaced not over 600 mm on centers horizontally, in courses not over 400 mm apart vertically, staggered in alternate courses. Ties shall be laid not closer than 16 mm to either masonry face. Ties shall not extend through control joints. Collar joints between masonry facing and masonry backup shall be filled solidly with grout.

### 3.5 MORTAR

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes, but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Ingredients not in containers, such as sand, shall be accurately measured by the use of measuring boxes. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2-1/2 hours after mixing shall be discarded.

### 3.6 REINFORCING STEEL

Reinforcement shall be cleaned of loose, flaky rust, scale, grease, mortar, grout, or other coating which might destroy or reduce its bond prior to placing grout. Bars with kinks or bends not shown on the drawings shall not be used. Reinforcement shall be placed prior to grouting. Unless otherwise indicated, vertical wall reinforcement shall extend to within 50 mm of tops of walls.

#### 3.6.1 Positioning Bars

Vertical bars shall be accurately placed within the cells at the positions indicated on the drawings. A minimum clearance of 13 mm shall be maintained between the bars and masonry units. Minimum clearance between parallel bars shall be one diameter of the reinforcement. Vertical reinforcing may be held in place using bar positioners located near the ends of each bar and at intermediate intervals of not more than 192 diameters of the reinforcement. Column and pilaster ties shall be wired in position around the vertical steel. Ties shall be in contact with the vertical reinforcement and shall not be placed in horizontal bed joints.

#### 3.6.2 Splices

Bars shall be lapped a minimum of 48 diameters of the reinforcement. Welded

or mechanical connections shall develop at least 125 percent of the specified yield strength of the reinforcement.

### 3.7 JOINT REINFORCEMENT

Joint reinforcement shall be installed at 400 mm on center or as indicated. Reinforcement shall be lapped not less than 150 mm. Prefabricated sections shall be installed at corners and wall intersections. The longitudinal wires of joint reinforcement shall be placed to provide not less than 16 mm cover to either face of the unit.

### 3.8 PLACING GROUT

Cells containing reinforcing bars shall be filled with grout. Hollow masonry units in walls or partitions supporting plumbing, heating, or other mechanical fixtures, voids at door and window jambs, and other indicated spaces shall be filled solid with grout. Cells under lintel bearings on each side of openings shall be filled solid with grout for full height of openings. Walls below grade, lintels, and bond beams shall be filled solid with grout. Units other than open end units may require grouting each course to preclude voids in the units. Grout not in place within 1-1/2 hours after water is first added to the batch shall be discarded. Sufficient time shall be allowed between grout lifts to preclude displacement or cracking of face shells of masonry units. If blowouts, flowouts, misalignment, or cracking of face shells should occur during construction, the wall shall be torn down and rebuilt.

#### 3.8.1 Vertical Grout Barriers for Fully Grouted Walls

Grout barriers shall be provided not more than 10 m apart, or as required, to limit the horizontal flow of grout for each pour.

#### 3.8.2 Horizontal Grout Barriers

Grout barriers shall be embedded in mortar below cells of hollow units receiving grout.

#### 3.8.3 Grout Holes and Cleanouts

##### 3.8.3.1 Grout Holes

Grouting holes shall be provided in slabs, spandrel beams, and other in-place overhead construction. Holes shall be located over vertical reinforcing bars or as required to facilitate grout fill in bond beams. Additional openings spaced not more than 400 mm on centers shall be provided where grouting of all hollow unit masonry is indicated. Openings shall not be less than 100 mm in diameter or 75 by 100 mm in horizontal dimensions. Upon completion of grouting operations, grouting holes shall be plugged and finished to match surrounding surfaces.

##### 3.8.3.2 Cleanouts for Hollow Unit Masonry Construction

Cleanout holes shall be provided at the bottom of every pour in cores containing vertical reinforcement when the height of the grout pour exceeds

1.5 m. Where all cells are to be grouted, cleanout courses shall be constructed using bond beam units in an inverted position to permit cleaning of all cells. Cleanout holes shall be provided at a maximum spacing of 800 mm where all cells are to be filled with grout. A new series of cleanouts shall be established if grouting operations are stopped for more than 4 hours. Cleanouts shall not be less than 75 by 100 mm openings cut from one face shell. Manufacturer's standard cutout units may be used at the Contractor's option. Cleanout holes shall not be closed until masonry work, reinforcement, and final cleaning of the grout spaces have been completed and inspected. For walls which will be exposed to view, cleanout holes shall be closed in an approved manner to match surrounding masonry.

#### 3.8.4 Grouting Equipment

##### 3.8.4.1 Grout Pumps

Pumping through aluminum tubes will not be permitted. Pumps shall be operated to produce a continuous stream of grout without air pockets, segregation, or contamination. Upon completion of each day's pumping, waste materials and debris shall be removed from the equipment, and disposed of outside the masonry.

##### 3.8.4.2 Vibrators

Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the grout. At least one spare vibrator shall be maintained at the site at all times. Vibrators shall be applied at uniformly spaced points not further apart than the visible effectiveness of the machine. Duration of vibration shall be limited to time necessary to produce satisfactory consolidation without causing segregation.

#### 3.8.5 Grout Placement

Masonry shall be laid to the top of a pour before placing grout. Grout shall not be placed in two-wythe solid unit masonry cavity until mortar joints have set for at least 3 days during hot weather and 5 days during cold damp weather. Grout shall not be placed in hollow unit masonry until mortar joints have set for at least 24 hours. Grout shall be placed using a hand bucket, concrete hopper, or grout pump to completely fill the grout spaces without segregation of the aggregates. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. The height of grout pours and type of grout used shall be limited by the dimensions of grout spaces as indicated in Table III. Low-lift grout methods may be used on pours up to and including 1.5 m in height. High-lift grout methods shall be used on pours exceeding 1.5 m in height.

##### 3.8.5.1 Low-Lift Method

Grout shall be placed at a rate that will not cause displacement of the masonry due to hydrostatic pressure of the grout. Mortar protruding more than 13 mm into the grout space shall be removed before beginning the grouting operation. Grout pours 300 mm or less in height shall be consolidated by mechanical vibration or by puddling. Grout pours over 300 mm in height shall be consolidated by mechanical vibration and reconsolidated

by mechanical vibration after initial water loss and settlement has occurred. Vibrators shall not be inserted into lower pours that are in a semi-solidified state. Low-lift grout shall be used subject to the limitations of Table III.

### 3.8.5.2 High-Lift Method

TABLE III

POUR HEIGHT AND TYPE OF GROUT FOR VARIOUS GROUT SPACE DIMENSIONS

Maximum Grout Pour Height (m) (4)	Grout Type	Grouting Procedure	Minimum Dimensions of the Total Clear Areas Within Grout Spaces and Cells (mm) (1,2)	
			Multiwythe Masonry (3)	Hollow-unit Masonry
0.3	Fine	Low Lift	20	40 x 50
1.5	Fine	Low Lift	50	50 x 75
2.4	Fine	High Lift	50	50 x 75
3.6	Fine	High Lift	65	65 x 75
7.3	Fine	High Lift	75	75 x 75
0.3	Coarse	Low Lift	40	40 x 75
1.5	Coarse	Low Lift	50	65 x 75
2.4	Coarse	High Lift	50	75 x 75
3.6	Coarse	High Lift	65	75 x 75
7.3	Coarse	High Lift	75	75 x 100

## Notes:

- (1) The actual grout space or cell dimension must be larger than the sum of the following items:
  - a) The required minimum dimensions of total clear areas given in the table above;
  - b) The width of any mortar projections within the space;
  - c) The horizontal projections of the diameters of the horizontal reinforcing bars within a cross section of the grout space or cell.
- (2) The minimum dimensions of the total clear areas shall be made up of one or more open areas, with at least one area being 20 mm or greater in width.
- (3) For grouting spaces between masonry wythes.
- (4) Where only cells of hollow masonry units containing reinforcement are grouted, the maximum height of the pour shall not exceed the distance between horizontal bond beams.

### 3.9 BOND BEAMS

Bond beams shall be filled with grout and reinforced as indicated on the drawings. Grout barriers shall be installed under bond beam units to retain the grout as required. Reinforcement shall be continuous, including around

corners, except through control joints or expansion joints, unless otherwise indicated on the drawings. Where splices are required for continuity, reinforcement shall be lapped 48 bar diameters. A minimum clearance of 13 mm shall be maintained between reinforcement and interior faces of units.

### 3.10 CONTROL JOINTS

Control joints shall be provided as indicated and shall be constructed by using mortar to fill the head joint in accordance with the details shown on the drawings. Sash jamb units shall have a 19 by 19 mm groove near the center at end of each unit. The vertical mortar joint at control joint locations shall be continuous, including through all bond beams. This shall be accomplished by utilizing half blocks in alternating courses on each side of the joint. The control joint key shall be interrupted in courses containing continuous bond beam steel. In single wythe exterior masonry walls, the exterior control joints shall be raked to a depth of 20 mm; backer rod and sealant shall be installed in accordance with Section 07900 JOINT SEALING. Exposed interior control joints shall be raked to a depth of 6 mm. Concealed control joints shall be flush cut.

### 3.11 BRICK EXPANSION JOINTS AND CONCRETE MASONRY VENEER JOINTS

Brick expansion joints and concrete masonry veneer joints shall be provided and constructed as shown on the drawings. Joints shall be kept free of mortar and other debris.

### 3.12 SHELF ANGLES

Shelf angles shall be adjusted as required to keep the masonry level and at the proper elevation. Shelf angles shall be galvanized. Shelf angles shall be provided in sections not longer than 3 m and installed with a 6 mm gap between sections. Shelf angles shall be mitered and welded at building corners with each angle not shorter than 1.2 m, unless limited by wall configuration.

### 3.13 LINTELS

#### 3.13.1 Masonry Lintels

Masonry lintels shall be constructed with lintel units filled solid with grout in all courses and reinforced with a minimum of two No. 4 bars in the bottom course unless otherwise indicated on the drawings. Lintel reinforcement shall extend beyond each side of masonry opening 40 bar diameters or 600 mm, whichever is greater. Reinforcing bars shall be supported in place prior to grouting and shall be located 15 mm above the bottom inside surface of the lintel unit.

#### 3.13.2 Precast Concrete and Steel Lintels

Precast concrete and steel lintels shall be as shown on the drawings. Lintels shall be set in a full bed of mortar with faces plumb and true. Steel and precast lintels shall have a minimum bearing length of 200 mm unless otherwise indicated on the drawings.

### 3.14 SILLS AND COPINGS

Sills and copings shall be set in a full bed of mortar with faces plumb and true.

### 3.15 ANCHORAGE TO CONCRETE AND STRUCTURAL STEEL

#### 3.15.1 Anchorage to Concrete

Anchorage of masonry to the face of concrete columns, beams, or walls shall be with dovetail anchors spaced not over 400 mm on centers vertically and 600 mm on center horizontally.

#### 3.15.2 Anchorage to Structural Steel

Masonry shall be anchored to vertical structural steel framing with adjustable steel wire anchors spaced not over 400 mm on centers vertically, and if applicable, not over 600 mm on centers horizontally.

### 3.16 POINTING AND CLEANING

After mortar joints have attained their initial set, but prior to hardening, mortar and grout daubs or splashings shall be completely removed from masonry-unit surfaces that will be exposed or painted. Before completion of the work, defects in joints of masonry to be exposed or painted shall be raked out as necessary, filled with mortar, and tooled to match existing joints. Immediately after grout work is completed, scum and stains which have percolated through the masonry work shall be removed using a high pressure stream of water and a stiff bristled brush. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Masonry surfaces shall be left clean, free of mortar daubs, dirt, stain, and discoloration, including scum from cleaning operations, and with tight mortar joints throughout. Metal tools and metal brushes shall not be used for cleaning.

#### 3.16.1 Concrete Masonry Unit and Concrete Brick Surfaces

Exposed concrete masonry unit and concrete brick surfaces shall be dry-brushed at the end of each day's work and after any required pointing, using stiff-fiber bristled brushes.

### 3.17 BEARING PLATES

Bearing plates for beams, joists, joist girders and similar structural members shall be set to the proper line and elevation with damp-pack bedding mortar, except where non-shrink grout is indicated. Bedding mortar and non-shrink grout shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

### 3.18 PROTECTION

Facing materials shall be protected against staining. Top of walls shall be covered with nonstaining waterproof covering or membrane when work is not in progress. Covering of the top of the unfinished walls shall continue until

the wall is waterproofed with a complete roof or parapet system. Covering shall extend a minimum of 600 mm down on each side of the wall and shall be held securely in place. Before starting or resuming, top surface of masonry in place shall be cleaned of loose mortar and foreign material.

### 3.19 TEST REPORTS

#### 3.19.1 Field Testing of Mortar

At least three specimens of mortar shall be taken each day. A layer of mortar 13 to 16 mm thick shall be spread on the masonry units and allowed to stand for one minute. The specimens shall then be prepared and tested for compressive strength in accordance with ASTM C 780.

#### 3.19.2 Field Testing of Grout

Field sampling and testing of grout shall be in accordance with the applicable provisions of ASTM C 1019. A minimum of three specimens of grout per day shall be sampled and tested. Each specimen shall have a minimum ultimate compressive strength of 13.8 MPa at 28 days.

#### 3.19.3 Efflorescence Test

Brick which will be exposed to weathering shall be tested for efflorescence. Tests shall be scheduled far enough in advance of starting masonry work to permit retesting if necessary. Sampling and testing shall conform to the applicable provisions of ASTM C 67. Units meeting the definition of "effloresced" will be subject to rejection.

#### 3.19.4 Prism Tests

At least one prism test sample shall be made for each 465 square meters of wall but not less than three such samples shall be made for any building. Three prisms shall be used in each sample. Prisms shall be tested in accordance with ASTM E 447. Seven-day tests may be used provided the relationship between the 7- and 28-day strengths of the masonry is established by the tests of the materials used. Compressive strength shall not be less than 9.3 MPa at 28 days. If the compressive strength of any prism falls below the specified value by more than 3.5 MPa, steps shall be taken to assure that the load-carrying capacity of the structure is not jeopardized. If the likelihood of low-strength masonry is confirmed and computations indicate that the load-carrying capacity may have been significantly reduced, tests of cores drilled, or prisms sawed, from the area in question may be required. In such case, three specimens shall be taken for each prism test more than 3.5 MPa below the specified value. Masonry in the area in question shall be considered structurally adequate if the average compressive strength of three specimens is equal to at least 85 percent of the specified value, and if the compressive strength of no single specimen is less than 75 percent of the specified value. Additional testing of specimens extracted from locations represented by erratic core or prism strength test results shall be permitted.

-- End of Section --

## SECTION 04220

NONBEARING MASONRY VENEER/STEEL STUD WALLS  
**09/98**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC ASD Manual (1989) Manual of Steel Construction Allowable Stress Design

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Mn1 (1996) Cold-Formed Steel Design Manual

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M (1997a) Carbon Structural Steel

ASTM C 67 (1999a) Sampling and Testing Brick and Structural Clay Tile

ASTM A 82 (1997a) Steel Wire, Plain, for Concrete Reinforcement

ASTM C 90 (1999a) Loadbearing Concrete Masonry Units

ASTM A 123/A 123M (1997a) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

ASTM A 153/A 153M (1998) Zinc Coating (Hot-Dip) on Iron and Steel Hardware

ASTM C 578 (1995) Rigid, Cellular Polystyrene Thermal Insulation

ASTM A 653/A 653M (1998) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM C 67 (1998a) Sampling and Testing Brick and



## Structural Clay Tile

ASTM C 79/C 79M	(1997) Treated Core and Non treated Core Gypsum Sheathing Board
ASTM C 90	(1998) Load-Bearing Concrete Masonry Units
ASTM C 91	(1998) Masonry Cement
ASTM C 216	(1998) Facing Brick (Solid Masonry Units Made from Clay or Shale)
ASTM C 270	(1997ael) Mortar for Unit Masonry
ASTM C 494	(1998) Chemical Admixtures for Concrete
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	(1994) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 665	(1998) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 744	(1998) Prefaced Concrete and Calcium Silicate Masonry Units
ASTM C 780	(1996) Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C 954	(1998) Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
ASTM C 955	(1998) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
ASTM C 1002	(1998) Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases
ASTM C 1072	(1998) Measurement of Masonry Flexural Bond Strength
ASTM C 1177/C 1177M	(1996) Glass Mat gypsum Substrate for Use as Sheathing
ASTM D 226	(1997a) Asphalt-Saturated Organic Felt Used

in Roofing and Waterproofing

ASTM D 1056	(1998) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1330	(1985; R 1995) Rubber Sheet Gaskets
ASTM D 1667	(1997) Flexible Cellular Materials - Vinyl Chlorine Polymers and Copolymers (Closed-Cell Foam)
ASTM D 2103	(1997) Polyethylene Film and Sheeting

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING  
(ASHRAE)

ASHRAE Hdbk-IP	(1997) Handbook, Fundamentals I-P Edition
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AMERICAN WELDING SOCIETY (AWS)

AWS D1.3	(1998) Structural Welding Code - Sheet Steel
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DEPARTMENT OF COMMERCE (DOC)

DOC PS 1	(1996) Voluntary Product Standard - Construction and Industrial Plywood
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

### SD-02 Shop Drawings

Masonry Veneer/Steel Stud Wall System; GA-BK, GA-DN, GA-HQ.

Details of cold-formed steel framing and support around openings, including framing connections, steel lintels, steel shelf angles, attachment to other building elements and bridging. Drawings shall indicate thickness, material, dimensions, protective coatings, and section properties of all steel lintels and shelf angles used in exterior wall framing. Drawings shall also indicate size and type of all fasteners including size and type of all welds.

### SD-04 Samples

Expansion Joint Materials; GA-BK, GA-DN, GA-HQ

Brick; GA-BK, GA-DN, GA-HQ

Concrete Masonry Units

Sample Panel; GA-BK, GA-CH, GA-DN, GA-HQ

A portable panel, approximately 600 by 600 mm, containing approximately 24 brick facings and 24 concrete masonry units to establish the range of color and texture. One of each type of masonry veneer anchor used.

#### SD-06 Test Reports

Masonry Veneer/Steel Stud Wall System

Calculations demonstrating the structural adequacy of steel lintels and shelf angles for the calculated gravity loads being supported; this analysis shall be in accordance with AISC ASD Manual. Test results demonstrating that the veneer anchors are structurally adequate to resist the specified loadings shall be submitted for approval. Calculations demonstrating the insulation shown on the drawings provides the specified U-value for heat transmission of the completed exterior wall construction; this analysis shall be in accordance with ASHRAE Hdbk-IP. Manufacturer's descriptive data and installation instructions for the insulation, the vapor barrier and the moisture barrier.

#### SD-07 Certificates

Brick  
Expansion Joint Materials  
Insulation  
Gypsum Sheathing  
Veneer Anchors  
Welders Qualification

Certificates stating that the materials and welders meet the requirements specified. Each certificate shall be signed by an authorized certification official and shall include their organization and position and shall identify the products covered under their certifying signature.

### 1.3 SAMPLE PANEL

After the material samples are approved and prior to starting masonry work, a sample masonry panel shall be built on the project site where directed. The sample panel shall be not less than 1.8 m long by 1.2 m high. The panel shall be of typical wall thickness for the construction represented. The panel shall show color range, texture, bond pattern, expansion joints, and cleaning of the masonry as required in the work. The panel shall also show cold-formed steel framing, insulation, gypsum wallboard, gypsum sheathing, ,

veneer anchors, , steel shelf angles, flashing and weep holes. The approved sample panel shall be used as a standard of workmanship required in the actual installation. The sample panel shall be protected from weather and construction operations and shall not be removed until the masonry veneer/steel stud wall work has been completed and accepted.

#### 1.4 DELIVERY, HANDLING AND STORAGE

Materials shall be delivered and handled avoiding chipping, breakage, bending or other damage, and contact with soil or other contaminating materials. The masonry products shall be stored off the ground and protected from inclement weather. Cementitious materials shall be delivered in unopened containers plainly marked and labeled with manufacturer's names and brands. Cementitious materials shall be stored in dry, weather-tight enclosures or covers. Sand and other aggregates shall be stored preventing contamination or segregation and under a weather-tight covering permitting good air circulation. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content galvanizing repair paint whenever necessary to prevent the formation of rust. Insulation, moisture barrier, and gypsum sheathing shall be stored in dry, well ventilated, weather-tight areas protected from sunlight and excessive heat. Air infiltration type vapor barrier shall be stored in accordance with the manufacturer's recommendations.

#### 1.5 EFFLORESCENCE TESTS

Efflorescence tests shall be performed by an approved commercial testing laboratory. Sampling for the tests shall be the responsibility of the Contractor. Brick shall be sampled and tested for efflorescence in accordance with ASTM C 67 and the rating shall be: "not effloresced".

### PART 2 PRODUCTS

#### 2.1 VENEER WYTHER

The source of masonry materials which will affect the appearance of the finished work shall not be changed after the work has started except with the Contracting Officer's approval. The Contractor has the option to use either hard metric or substitute inch-pound (soft-metric) masonry products. If the Contractor decides to substitute inch-pound masonry products, the following additional requirements shall be met:

- a. The dimensions indicated on the drawings shall not be altered to accommodate inch-pound masonry products either horizontally or vertically. The 100 mm building module shall be maintained, except for the actual physical size of the masonry products themselves.
- b. Mortar joint widths shall be maintained as specified.
- c. Masonry inch-pound products shall not be reduced in size by more than one-third (1/3) in height and one-half (1/2) in length. Masonry products shall not be cut at ends of walls, corners, and other openings.

d. Cut, exposed masonry products shall be held to a minimum and shall be located where they will have the least impact on the aesthetics of the facility.

e. Other building components built into the masonry products, such as window frames, door frames, louvers, fire dampers, etc., that are required to be metric, shall remain metric.

f. Additional metric guidance shall conform to Section 01415 METRIC MEASUREMENTS.

#### 2.1.1 Clay or Shale Brick

Clay or shale brick veneer shall be masonry units conforming to ASTM C 216, Type FBS . Color range and texture shall be as indicated and shall conform to the approved sample. Grade SW shall be used for all brickwork. Brick unit sizes shall be modular

#### 2.1.2 Concrete Masonry Unit

Concrete masonry unit veneer shall be solid and conform to ASTM C 90, Type I. Architectural type, color range and texture shall be as indicated and shall conform to the approved sample. Masonry unit sizes shall be modular.

### 2.2 MORTAR

Mortar shall conform to ASTM C 270, Type S Mortar mix shall be based on proportion specifications. Laboratory testing of mortar shall be in accordance with the preconstruction evaluation of mortar section of ASTM C 780. Cement shall have a low alkali content and be of one brand. Aggregates shall be from one source.

#### 2.2.1 Masonry Cement

Masonry cement shall not be used.

#### 2.2.2 Admixtures

In cold weather, a non-chloride based accelerating admixture may be used subject to approval. Accelerating admixtures shall be non-corrosive, contain less than 0.2 percent chlorides, and conform to ASTM C 494, Type C.

### 2.3 COLD-FORMED STEEL FRAMING

Cold-formed framing shall consist of steel studs, top and bottom tracks, runners, horizontal bridging, and other cold-formed members and other accessories. All members and components made of sheet steel shall be hot-dip galvanized in accordance with ASTM A 653/A 653M with a minimum coating thickness of G 60. Framing covered herein shall be used only in framing the exterior masonry veneer steel stud wall system as indicated on the drawings. Metal framing for interior partitions are specified in Section 09250 GYPSUM WALLBOARD.

#### 2.3.1 Steel Studs

Studs shall be furnished as shown in the contract drawings. Refer Section 05400, COLD FORMED STEEL FRAMING.

## 2.4 INSULATION

### 2.4.1 Blanket Insulation

Insulation placed between the steel studs shall be batt or blanket type mineral wool conforming to ASTM C 665, Type II

### 2.4.2 Rigid Board-Type Insulation

Insulation for wall cavities shall be rigid board-type insulation. Rigid board-type insulation shall be polyurethane conforming to ASTM C 591, or polyisocyanurate conforming to ASTM C 1289, Type II. Insulation thickness shall be sufficient to provide an R-value as shown on the drawings.

## 2.5 GYPSUM WALLBOARD

Gypsum wallboard that is installed on the interior side of the cold-formed steel framing system shall be as specified in Section 09250 GYPSUM WALLBOARD.

## 2.6 EXTERIOR SHEATHING

Gypsum sheathing that is installed on the exterior side of the cold-formed steel framing system shall have a minimum thickness of 13 mm and shall be 1.2 m wide. Gypsum sheathing shall conform to ASTM C 79/C 79M. Gypsum sheathing shall have a water-resistant gypsum core with a water-repellent paper firmly bonded to the core.

## 2.7 MOISTURE PROTECTION

### 2.7.1 Moisture Barrier

The moisture barrier shall be tear and puncture resistant olefin building wrap with a transmission rate of 200 g per square meter per 24 hours as per ASTM E 96.

### 2.7.2 Vapor Retarder

The vapor retarder shall be polyethylene film conforming to ASTM D 2103, 0.15 mm minimum thickness. Vapor barrier shall have a vapor transmission rate of 29 ng per Pa per second per square meter (0.5 perms).

### 2.7.3 Staples

Staples for attaching the moisture barrier to the exterior sheathing shall be the type and size best suited to provide a secure connection. Staples shall be made from either galvanized steel or stainless steel wire.

### 2.7.4 Joint Tape

Tape for sealing the joints in the GYPSUM SHEATHING shall be fabric

reinforced, rubberized asphalt joint tape by one of the following or approved equal. Provide Polyguard 650LT primer or as recommended by the selected dampproofing manufacturer. Polyguard No. JY-60 Joint Tape Perma-A-Barrier Seam Tape by Grace 108JTN Joint Tape by Royston.

## 2.8 VENEER ANCHORS

Anchor assemblies for the attachment of the masonry veneer to the cold-formed steel framing, structural steel and column members, and concrete floor slabs shall be designed for the design loadings shown. Anchors shall transfer the design loadings from the masonry veneer to the cold-formed steel framing system or other support without exceeding the allowable stresses and deflections in the anchors. Length of anchor wires shall be such that the outermost wires lie between 32 mm from each face of the masonry veneer. Anchors wires shall not have drips. Wires for veneer anchors shall be rectangular or triangular hoops formed from 5 mm diameter steel wire conforming to ASTM A 82. Anchor assemblies including wires and anchor plates shall be hot-dip galvanized conforming to ASTM A 153/A 153M, Class B-2. The veneer anchor shall have a minimum capacity of 900 newtons. The load-displacement capacity of each veneer anchor, both in direct pull-out for tension and compression, shall be not less than 350 kilo newtons per meter or a deflection of 2.85 mm per kilo newton of load in tension or compression. In the direction perpendicular to the masonry veneer, the anchor assembly shall have a maximum play of 1.6 mm.

## 2.9 CONNECTIONS

Screws, bolts and anchors shall be hot-dip galvanized in accordance with ASTM A 123/A 123M or ASTM A 153/A 153M as appropriate.

### 2.9.1 Welding

Refer to Section 05400, COLD FORMED METAL FRAMING.

### 2.9.2 Veneer Anchor Screws

Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene washer, #10 diameter by length required to penetrate steel stud flange by not less than 3 exposed threads, and with the following corrosion protective coating:

Organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117

### 2.9.3 Gypsum Sheathing Screws

Type S steel drill screws, 25 mm long, with organic polymer coating or other corrosion-protective coating having a salt-spray resistance of more than 800 hours per ASTM B 117. Screws for attachment of gypsum sheathing to cold-formed steel framing shall conform to ASTM C 954.

## 2.10 SYNTHETIC RUBBER WASHERS

Synthetic rubber washers for placement between veneer anchors and the gypsum

sheathing on the outside face of the exterior sheathing shall conform to ASTM D 1330, Grade I.

#### 2.11 EXPANSION JOINT MATERIAL

Expansion joint materials shall be bellows or U-shaped type conforming to Section 07600 SHEET METALWORK, GENERAL. Premolded type shall be closed-cell cellular rubber conforming to ASTM D 1056 or closed-cell vinyl or polyvinyl chloride conforming to ASTM D 1667.

#### 2.12 FLASHING

Stainless steel flashing shall conform to the requirements in Section 07600 SHEET METALWORK, GENERAL. Flashing shall be supplied in a continuous sheet extending from the exterior sheathing across the cavity and through the masonry veneer as shown.

#### 2.13 STEEL LINTELS AND SHELF ANGLES

Steel shapes used for lintels and shelf angles shall conform to ASTM A 36/A 36M. Lintels and shelf angles shall be provided as shown. These steel members shall be hot-dip galvanized in accordance with ASTM A 123/A 123M.

#### 2.14 CAULKING AND SEALANTS

Caulking and sealants shall be as specified in Section 07900 JOINT SEALING.

#### 2.15 WEEP VENTS

Weep vents shall be Mortar Net vents or equal with a 90 percent open ultraviolet resistant recycled polyester mesh bonded with flame retardant adhesive, and shall match the mortar color.

### PART 3 EXECUTION

#### 3.1 GENERAL INSTALLATION REQUIREMENTS

Wall sections, types of construction and dimensions shall be as shown. Metal door and window frames and other special framing shall be built and anchored into the wall system as indicated.

#### 3.2 STEEL STUD WALL FRAMING

The top track of the stud wall system shall be slip jointed to accommodate vertical deflections of the supporting members as shown on the drawings. Top and bottom tracks shall be securely anchored to resist track rotation by alternating fastener locations to provide two rows, one row near each track flange as shown on the drawings. Both flanges of all steel studs shall be securely fastened with screws to the flanges of the top and bottom tracks as shown on the drawings. All details for affixing steel studs to runners and all other sheet steel framing members along with all details necessary for anchorage of the steel stud wall system to the building structural systems shall be as shown on the drawings. Horizontal bridging shall be provided as necessary. Studs shall be spaced as required to resist the specified design



wind or seismic loadings, but not exceeding 600 mm on center. Coordinate stud spacing with sheathing and anchor requirements. At wall openings for doors, windows and other similar features, the framing system shall provide for the installation and anchorage of the required subframes or finish frames. Steel frames shall be securely attached through built-in anchors to the nearest stud on each side of the opening with self-drilling screws. Double studs shall be provided at both jambs of all door openings. Door frames and other built-in items shall be grouted solid.

### 3.3 STEEL SHELF ANGLES

Unless otherwise shown, steel shelf angles shall be provided in segments that do not exceed 3.0 m in length. At building corners, shelf angle segments shall be mitered and securely attached together by welding with legs no less than 1.2 m where possible. Shelf angle segments shall not be connected together but instead shall be installed with 6 mm wide gaps between the segments. Fabrication and erection tolerances shall be in accordance with the AISC Code of Standard Practice, as indicated in AISC ASD Manual.

### 3.4 INSULATION

The actual installed thickness of insulation shall provide a minimum thermal R of that indicated on the drawings for the completed exterior wall construction as determined in accordance with ASHRAE Hdbk-IP. Refer to the drawings for table of R-Values. Insulation thickness shall be as shown on the approved drawings. Installation, except as otherwise specified or shown, shall be in accordance with the manufacturer's instructions which shall be approved by the Contracting Officer. Insulation shall be installed between wall framing members. Rigid insulation shall be installed in accordance with the manufacturer's instructions with proper connections through the insulation to prevent the insulation from carrying loads directly. Insulation with facings shall be secured to the sides of the framing members to provide a continuous seal so that the entire weight of the insulation is carried by the framing members. Where electrical outlets, ducts, pipes, vents or other utility items occur, insulation shall be placed on the dry side of the item away from excessive humidity.

### 3.5 GYPSUM WALLBOARD

Gypsum wallboard shall be installed on the interior face of the cold-formed steel framing system. Installation shall be as specified in Section 09250 GYPSUM WALLBOARD except at vertical slip joints, the gypsum wallboard shall be connected to the vertical studs to prevent movement at the slip joint.

### 3.6 EXTERIOR SHEATHING

Sheathing shall be installed on the exterior face of the cold-formed steel framing system with self-drilling screws. Screws shall be located a minimum of 10 mm from the ends and edges of sheathing panels and shall be spaced not more than 200 mm on each supporting member except at vertical slip joints, the sheathing shall be connected to the vertical studs to prevent movement of the slip joint. Edges and ends of gypsum sheathing panels shall be butted snugly with vertical joints staggered to provide full and even

support for the moisture barrier. Holes and gaps resulting from abandoned screw installations, from damage to panels, and from cutting and fitting of panels at junctures with doors, windows, foundation walls, floor slabs and other similar locations shall be filled with exterior rubber-base caulk.

### 3.7 MOISTURE PROTECTION

#### 3.7.1 Moisture Barrier

The moisture barrier shall be installed on the outer face of the exterior sheathing. Vertical end joints shall be lapped not less than 150 mm and shall be staggered. Attachment of the moisture barrier shall be in accordance with manufacturer's recommendations.

#### 3.7.2 Vapor Retarder

A vapor retarder shall be installed between the steel studs and the gypsum wall board. The vapor retarder shall be installed in accordance with the manufacturer's recommendations to form a complete retarder to vapor infiltration. The joints shall be lapped and sealed with tape.

### 3.8 VENEER ANCHORS

Veneer anchors shall be attached with screws through the sheathing to the steel studs or other support members at the locations shown. Veneer anchors shall be installed with the outermost wires lying between 16 mm from each face of the masonry veneer. Synthetic rubber washers shall be used between the anchor connector plates and the sheathing. A clutch torque slip screw gun shall be used on screws attaching veneer anchors to cold-formed steel members. Veneer anchors with corrugated sheet metal or wire mesh members extending across the wall cavity shall not be used. There shall be one veneer anchor for each 0.2 square meters of wall and shall be attached to steel studs and other supports with a maximum spacing of 600 mm on center.

### 3.9 FLASHING

Continuous flashing shall be provided at the bottom of the wall cavity just above grade. Flashing shall also be provided above and below openings at lintels and sills, at shelf angles, and as indicated on the drawings. Flashing shall be as detailed and as specified in Section 07600 SHEET METALWORK, GENERAL. Flashing shall be lapped a minimum of 150 mm at joints and shall be sealed with a mastic as recommended by the flashing manufacturer. Ends over doors, windows and openings shall be turned up and secured. Flashing shall be lapped under the moisture barrier a minimum of 150 mm and securely attached to the gypsum sheathing. Flashing shall extend through the exterior face of the masonry veneer and shall be turned down to form a drip.

### 3.10 MASONRY VENEER

Exterior masonry wythes shall be constructed to the thickness indicated on the drawings. A cavity consisting of a 50 mm minimum width air space will be provided between the moisture barrier and the masonry veneer. Masonry veneer shall not be installed until the exterior sheathing, moisture

barrier, veneer anchors and flashing have been installed on the cold-formed steel framing system. Extreme care shall be taken to avoid damage to the moisture barrier and flashing during construction of the masonry veneer. Any portion of the moisture barrier and flashing that is damaged shall be repaired or replaced prior to completion of the veneer. Masonry shall be placed in running bond pattern. Vertical joints on alternating courses shall be aligned and kept vertically plumb. Units shall be shoved into place so that the vertical mortar joints are completely full and tight. Units that have been disturbed after the mortar has stiffened shall be removed, cleaned and relaid. Mortar which protrudes more than 13 mm into the cavity space shall be removed. Means shall be provided to ensure that the cavity space is kept clean of mortar droppings and other loose debris. Chases and raked-out joints shall be kept free from mortar and debris. Faces of units used in finished exposed areas shall be free from chipped edges, material texture or color defects or other imperfections distracting from the appearance of the finished work.

#### 3.10.1 Surface Preparation

Surfaces on which masonry is to be laid shall be cleaned of laitance or other foreign material. No units having a film of water shall be laid.

#### 3.10.2 Hot Weather Construction

Temperatures of masonry units and mortar shall not be greater than 50 degrees C when laid. Masonry erected when the ambient air temperature is more than 37 degrees C in the shade and when the relative humidity is less than 50 percent shall be given protection from the direct exposure to wind and sun for 48 hours after the installation.

#### 3.10.3 Cold Weather Construction

Temperatures of masonry units and mortar shall not be less than 4 degrees C when laid. When the ambient air temperature is 0 degrees C or less, masonry veneer under construction shall be protected and maintained at a temperature greater than 0 degrees C for a period of 48 hours after installation. The proposed method of maintaining the temperature within the specified range shall be submitted for approval prior to implementation. No units shall be laid on a surface having a film of frost or water.

#### 3.10.4 Tolerances

Masonry shall be laid plumb, level and true to line within the tolerances specified in TABLE 1. All masonry corners shall be square unless otherwise indicated on the drawings.

TABLE 1

Variation From Plumb	
In adjacent units	3 mm
In 3 m	6 mm
In 6 m	10 mm

In 12 m or more	13 mm
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#### Variation From Level Or Grades

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In 3 m	3 mm
In 6 m	6 mm
In 12 m or more	13 mm

#### Variation From Linear Building Lines

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In 6 m	13 mm
In 12 m or more	19 mm

#### Variation From Cross Sectional Dimensions Of Walls

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Plus	13 mm
Minus	6 mm

### 3.10.5 Mixing of Mortar

Mortar shall be mixed in a mechanically operated mortar mixer for at least 3 minutes but not more than 5 minutes. Measurement of ingredients for mortar shall be by volume. Measurement of sand shall be accomplished by the use of a container of known capacity or shovel count based on a container of known capacity. Water shall be mixed with the dry ingredients in sufficient amount to provide a workable mixture which will adhere to the vertical surfaces of the masonry units. Mortar that has stiffened because of loss of water through evaporation shall be retempered by adding water to restore the proper consistency and workability. Mortar that has reached its initial set or that has not been used within 2-1/2 hours shall be discarded.

### 3.10.6 Cutting and Fitting

Wherever possible, full units shall be used in lieu of cut units. Where cut units are required to accommodate the design, cutting shall be done by masonry mechanics using power masonry saws. Wet-cut units shall be dried to the same surface-dry appearances of uncut units before being placed in the work. Cut edges shall be clean, true and sharp. Openings to accommodate pipes, conduits, and other accessories shall be neatly formed so that framing or escutcheons required will completely conceal the cut edges. Insofar as practicable, all cutting and fitting shall be accomplished while masonry work is being erected.

### 3.10.7 Masonry Units

When being laid, masonry units shall have suction sufficient to hold the mortar and to absorb water from the mortar, but shall be damp enough to allow the mortar to remain in a plastic state to permit the unit to be leveled and plumbed immediately after being laid without destroying bond. Masonry units with frogging shall be laid with the frog side down and better

or face side exposed to view. Masonry units that are cored, recessed or otherwise deformed may be used in sills or in other areas except where deformations will be exposed to view.

#### 3.10.8 Mortar Joints

Mortar joint widths shall be uniform and such that the specified widths are maintained throughout. Joints shall be of thickness equal to the difference between the actual and nominal dimensions of the masonry units in either height or length but in no case shall the joints be less than 6 mm nor more than 13 mm wide. Joints shall be tooled slightly concave. Tooling shall be accomplished when mortar is thumbprint hard and in a manner that will compress and seal the mortar joint and produce joints of straight and true lines free of tool marks.

#### 3.10.9 Veneer Joints

Brick expansion joints shall be provided at the locations shown on the drawings. Details of joints shall be as indicated on the drawings. Joints shall be clean and free of mortar and shall contain only backer rod and sealant, installed in accordance with Section 07900 JOINT SEALING. Horizontal reinforcement shall not extend through the joints.

#### 3.10.10 Weep Holes

Weep holes shall be provided at all flashing locations at intervals of 600 mm. Weep holes shall be placed in head joints just above the flashing. Weep holes shall be formed by leaving head joints open or head joint vents may be used. Weep holes shall be kept free of mortar and other obstructions.

#### 3.10.11 Head Joint Vents

Head joint vents shall be provided near the top of the veneer wythe at the same spacing as the weep holes.

#### 3.10.12 Discontinuous Work

When necessary to temporarily discontinue the work, masonry shall be stepped back for joining when work resumes. Toothing may be used only when specifically approved. Before resuming work, loose mortar shall be removed and the exposed joint shall be thoroughly cleaned. Top of walls subjected to rain or snow shall be covered with nonstaining waterproof covering or membrane when work is not in process. Covering shall extend a minimum of 600 mm down on each side of the wall and shall be held securely in place.

#### 3.10.13 Cleaning

Mortar daubs or splashings shall be completely removed from finished exposed masonry surfaces before they harden or set up. Before completion of the work, defects in mortar joints shall be raked out as necessary, filled with mortar, and tooled to match the adjacent existing mortar in the joints. The proposed cleaning method shall be done on the sample wall panel and the sample panel shall be examined for discoloration or stain. If the sample panel is discolored or stained, the method of cleaning shall be changed to

ensure that the masonry surfaces in the structure will not be adversely affected. Masonry surfaces shall not be cleaned, other than removing excess surface mortar, until mortar in joints has hardened. Cleaning shall be accomplished with the use of stiff bristle fiber brushes, wooden paddles, wooden scrapers, or other suitable nonmetallic tools. The exposed brick surfaces shall be saturated with water and cleaned with a proprietary brick cleaning agent recommended by the clay products manufacturer. The cleaning agent shall not adversely affect the brick masonry surfaces. Proprietary cleaning agents shall be used in conformance with the cleaning product manufacturer's printed recommendations. Efflorescence or other stains shall be removed in conformance with the recommendations of the masonry unit manufacturer. After construction and cleaning, masonry surfaces shall be left clean, free of mortar daubs, stain, and discolorations, including scum from cleaning operations, and will have tight mortar joints throughout. Metallic tools and brushes shall not be used for cleaning.

### 3.11 BUILDING EXPANSION JOINTS

Expansion joints shall be located where indicated and shall be of the size and details shown.

-- End of Section --

DIVISION 5 – METALS

05090	Welding, Structural
05120	Structural Steel
05210	Steel Joists
05300	Steel Decking
05400	Cold-Formed Steel Framing
05500	Miscellaneous Metal

## SECTION 05090

WELDING, STRUCTURAL  
09/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC ASD Spec	(1989) Specification for Structural Steel Buildings - Allowable Stress Design, Plastic Design
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## AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ASNT RP SNT-TC-1A	(1996) Recommended Practice SNT-TC-1A
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## AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(1998) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS A3.0	(1994) Standard Welding Terms and Definitions
AWS D1.1	(1998) Structural Welding Code - Steel
AWS Z49.1	(1999) Safety in Welding and Cutting and Allied Processes

## 1.2 DEFINITIONS

Definitions of welding terms shall be in accordance with AWS A3.0.

## 1.3 GENERAL REQUIREMENTS

The design of welded connections shall conform to AISC ASD Spec unless otherwise indicated or specified. Material with welds will not be accepted unless the welding is specified or indicated on the drawings or otherwise approved. Welding shall be as specified in this section, except where additional requirements are shown on the drawings or are specified in other sections. Welding shall not be started until welding procedures, inspectors, nondestructive testing personnel, welders, welding operators, and tackers have been qualified and the submittals approved by the Contracting Officer. Qualification testing shall be performed at or near the work site. Each Contractor performing welding shall maintain records of



the test results obtained in welding procedure, welder, welding operator, and tacker performance qualifications.

#### 1.3.1 Pre-erection Conference

A pre-erection conference shall be held, prior to the start of the field welding, to bring all affected parties together and to gain a naturally clear understanding of the project and the Welding Procedure Specifications (WPS) (which the Contractor shall develop and submit for all welding, including welding done using prequalified procedures). Attendees shall include all Contractor's welding production and inspection personnel and appropriate Government personnel. Items for discussion could include: responsibilities of various parties; welding procedures and processes to be followed; welding sequence (both within a joint and joint sequence within the building); inspection requirements and procedures, both visual and ultrasonic; welding schedule; fabrication of mock-up model; and other items deemed necessary by the attendees.

#### 1.3.2 Mock-up Model

The field-welded connection designated as the mock-up model on the drawings shall be the first connection made. All welders qualified and designated to perform field-welded groove joints shall be present during the welding of the mock-up model connections and each one shall perform a part of the welding. The mock-up test shall simulate the physical and environmental conditions that will be encountered during the welding of all groove joints.

All inspection procedures required for groove welded joints, including NDE tests, shall be performed on the mock-up model. All Contractor inspection and testing personnel that will perform QC of groove welded joints shall be present during the welding of the mock-up model and each one shall perform the inspection procedures to be performed on production welding of these joints. This mock-up model connection shall be the standard of performance, both for the welding and inspection procedures used and the results to be achieved in the production welding for these groove welded joints.

#### 1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

SD-07 Certificates

Welding Procedure Qualifications; GA-BK, GA-CH, GA-DN, GA-HQ

Welder, Welding Operator, and Tacker Qualification; GA-BK, GA-CH, GA-DN,

GA-HQ

Inspector Qualification; GA-BK, GA-CH, GA-DN, GA-HQ

Previous Qualifications

Prequalified Procedures

Copies of the welding procedure specifications; the procedure qualification test records; and the welder, welding operator, or tacker qualification test records.

Quality Control

A quality assurance plan and records of tests and inspections.

#### 1.5 WELDING PROCEDURE QUALIFICATIONS

Except for prequalified (per AWS D1.1) and previously qualified procedures, each Contractor performing welding shall record in detail and shall qualify the welding procedure specification for any welding procedure followed in the fabrication of weldments. Qualification of welding procedures shall conform to AWS D1.1 and to the specifications in this section. Copies of the welding procedure specification and the results of the procedure qualification test for each type of welding which requires procedure qualification shall be submitted for approval. Approval of any procedure, however, will not relieve the Contractor of the sole responsibility for producing a finished structure meeting all the requirements of these specifications. This information shall be submitted on the forms in Appendix E of AWS D1.1. Welding procedure specifications shall be individually identified and shall be referenced on the detail drawings and erection drawings, or shall be suitably keyed to the contract drawings. In case of conflict between this specification and AWS D1.1, this specification governs.

##### 1.5.1 Previous Qualifications

Welding procedures previously qualified by test may be accepted for this contract without requalification if the following conditions are met:

- a. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.
- b. The qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.
- c. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

##### 1.5.2 Prequalified Procedures

Welding procedures which are considered prequalified as specified in AWS D1.1

will be accepted without further qualification. The Contractor shall submit for approval a listing or an annotated drawing to indicate the joints not prequalified. Procedure qualification shall be required for these joints.

#### 1.5.3 Retests

If welding procedure fails to meet the requirements of AWS D1.1, the procedure specification shall be revised and requalified, or at the Contractor's option, welding procedure may be retested in accordance with AWS D1.1. If the welding procedure is qualified through retesting, all test results, including those of test welds that failed to meet the requirements, shall be submitted with the welding procedure.

#### 1.6 WELDER, WELDING OPERATOR, AND TACKER QUALIFICATION

Each welder, welding operator, and tacker assigned to work on this contract shall be qualified in accordance with the applicable requirements of AWS D1.1 and as specified in this section. Welders, welding operators, and tackers who make acceptable procedure qualification test welds will be considered qualified for the welding procedure used.

##### 1.6.1 Previous Personnel Qualifications

At the discretion of the Contracting Officer, welders, welding operators, and tackers qualified by test within the previous 6 months may be accepted for this contract without requalification if all the following conditions are met:

a. Copies of the welding procedure specifications, the procedure qualification test records, and the welder, welding operator, and tacker qualification test records are submitted and approved in accordance with the specified requirements for detail drawings.

b. Testing was performed by an approved testing laboratory, technical consultant, or the Contractor's approved quality control organization.

c. The previously qualified welding procedure conforms to the requirements of this specification and is applicable to welding conditions encountered under this contract.

d. The welder, welding operator, and tacker qualification tests conform to the requirements of this specification and are applicable to welding conditions encountered under this contract.

##### 1.6.2 Certificates

Before assigning any welder, welding operator, or tacker to work under this contract, the Contractor shall submit the names of the welders, welding operators, and tackers to be employed, and certification that each individual is qualified as specified. The certification shall state the type of welding and positions for which the welder, welding operator, or tacker is qualified, the code and procedure under which the individual is qualified, the date qualified, and the name of the firm and person

certifying the qualification tests. The certification shall be kept on file, and 3 copies shall be furnished. The certification shall be kept current for the duration of the contract.

#### 1.6.3 Renewal of Qualification

Requalification of a welder or welding operator shall be required under any of the following conditions:

a. It has been more than 6 months since the welder or welding operator has used the specific welding process for which he is qualified.

b. There is specific reason to question the welder or welding operator's ability to make welds that meet the requirements of these specifications.

c. The welder or welding operator was qualified by an employer other than those firms performing work under this contract, and a qualification test has not been taken within the past 12 months. Records showing periods of employment, name of employer where welder, or welding operator, was last employed, and the process for which qualified shall be submitted as evidence of conformance.

d. A tacker who passes the qualification test shall be considered eligible to perform tack welding indefinitely in the positions and with the processes for which he is qualified, unless there is some specific reason to question the tacker's ability. In such a case, the tacker shall be required to pass the prescribed tack welding test.

#### 1.7 INSPECTOR QUALIFICATION

Inspector qualifications shall be in accordance with AWS D1.1. Nondestructive testing personnel shall be qualified in accordance with the requirements of ASNT RP SNT-TC-1A for Levels I or II in the applicable nondestructive testing method. The inspector may be supported by assistant welding inspectors who are not qualified to ASNT RP SNT-TC-1A, and assistant inspectors may perform specific inspection functions under the supervision of the qualified inspector.

#### 1.8 SYMBOLS

Symbols shall be in accordance with AWS A2.4, unless otherwise indicated.

#### 1.9 SAFETY

Safety precautions during welding shall conform to AWS Z49.1.

### PART 2 PRODUCTS

#### 2.1 WELDING EQUIPMENT AND MATERIALS

All welding equipment, electrodes, welding wire, and fluxes shall be capable of producing satisfactory welds when used by a qualified welder or welding operator performing qualified welding procedures. All welding equipment and

materials shall comply with the applicable requirements of AWS D1.1.

### PART 3 EXECUTION

#### 3.1 WELDING OPERATIONS

##### 3.1.1 Requirements

Workmanship and techniques for welded construction shall conform to the requirements of AWS D1.1 and AISC ASD Spec. When AWS D1.1 and the AISC ASD Spec specification conflict, the requirements of AWS D1.1 shall govern.

##### 3.1.2 Identification

Welds shall be identified in one of the following ways:

a. Written records shall be submitted to indicate the location of welds made by each welder, welding operator, or tacker.

b. Each welder, welding operator, or tacker shall be assigned a number, letter, or symbol to identify welds made by that individual. The Contracting Officer may require welders, welding operators, and tackers to apply their symbol next to the weld by means of rubber stamp, felt-tipped marker with waterproof ink, or other methods that do not cause an indentation in the metal. For seam welds, the identification mark shall be adjacent to the weld at 1 meter intervals. Identification with die stamps or electric etchers shall not be allowed.

#### 3.2 QUALITY CONTROL

Testing shall be done by an approved inspection or testing laboratory or technical consultant; or if approved, the Contractor's inspection and testing personnel may be used instead of the commercial inspection or testing laboratory or technical consultant. The Contractor shall perform visual and radiographic, ultrasonic, magnetic particle, and dye penetrant inspection to determine conformance with paragraph STANDARDS OF ACCEPTANCE. Procedures and techniques for inspection shall be in accordance with applicable requirements of AWS D1.1, except that in radiographic inspection only film types designated as "fine grain," or "extra fine," shall be employed.

#### 3.3 STANDARDS OF ACCEPTANCE

Dimensional tolerances for welded construction, details of welds, and quality of welds shall be in accordance with the applicable requirements of AWS D1.1 and the contract drawings. All welds shall be visually inspected. Nondestructive testing shall be by visual inspection and radiographic, or dye penetrant methods. The minimum extent of nondestructive testing shall be random 10 percent of welds or joints, as indicated on the drawings. All full penetration welds or joints shall be tested using ultrasonic or radiographic methods.

##### 3.3.1 Nondestructive Examination

The welding shall be subject to inspection and tests in the mill, shop, and field. Inspection and tests in the mill or shop will not relieve the Contractor of the responsibility to furnish weldments of satisfactory quality. When materials or workmanship do not conform to the specification requirements, the Government reserves the right to reject material or workmanship or both at any time before final acceptance of the structure containing the weldment.

### 3.3.2 Destructive Tests

When metallographic specimens are removed from any part of a structure, the Contractor shall make repairs. The Contractor shall employ qualified welders or welding operators, and shall use the proper joints and welding procedures, including peening or heat treatment if required, to develop the full strength of the members and joints cut and to relieve residual stress.

### 3.4 GOVERNMENT INSPECTION AND TESTING

In addition to the inspection and tests performed by the Contractor for quality control, the Government will perform inspection and testing for acceptance to the extent determined by the Contracting Officer. The costs of such inspection and testing will be borne by the Contractor if unsatisfactory welds are discovered, or by the Government if the welds are satisfactory. The work may be performed by the Government's own forces or under a separate contract for inspection and testing. The Government reserves the right to perform supplemental nondestructive and destructive tests to determine compliance with paragraph STANDARDS OF ACCEPTANCE.

### 3.5 CORRECTIONS AND REPAIRS

When inspection or testing indicates defects in the weld joints, the welds shall be repaired using a qualified welder or welding operator as applicable. Corrections shall be in accordance with the requirements of AWS D1.1 and the specifications. Defects shall be repaired in accordance with the approved procedures. Defects discovered between passes shall be repaired before additional weld material is deposited. Wherever a defect is removed and repair by welding is not required, the affected area shall be blended into the surrounding surface to eliminate sharp notches, crevices, or corners. After a defect is thought to have been removed, and before rewelding, the area shall be examined by suitable methods to ensure that the defect has been eliminated. Repair welds shall meet the inspection requirements for the original welds. Any indication of a defect shall be regarded as a defect, unless reevaluation by nondestructive methods or by surface conditioning shows that no unacceptable defect is present.

-- End of Section --

## SECTION 05093

WELDING PRESSURE PIPING  
09/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR NONDESTRUCTIVE TESTING (ASNT)

ASNT RP SNT-TC-1A	(1996) Recommended Practice SNT-TC-1A
ASNT Q+A Bk A	(1996) Question and Answer Book A: Radiographic Test Method; Levels I, II, III (Supplement to Recommended Practice SNT-TC-1A)
ASNT RP SNT-TC-1A Bk B	(1994) Question and Answers Levels I, II, and III Magnetic Particle Method Book B (Supplement to RP SNT-TC-1A)
ASNT Q+A Bk C	(1994) Question and Answer Book C: Ultrasonic Testing Method; Levels I, II, III (Supplement to RP SNT-TC-1A)
ASNT Q+A Bk D	(1996) Question and Answer Book D: Liquid Penetrant Testing Method; Levels I, II, III (Supplement to RP SNT-TC-1A)

## ASME INTERNATIONAL (ASME)

ASME B31.1	(1998) Power Piping
ASME B31.3	(1999) Process Piping
ASME B31.4	(1992; B31.4a) Liquid Transportation Systems for Hydrocarbons, Liquid Petroleum Gas, Anhydrous Ammonia, and Alcohols
ASME B31.5	(1992; B31.5a) Refrigeration Piping
ASME B31.8	(1995) Gas Transmission and Distribution Piping Systems
ASME BPV I	(1998) Boiler and Pressure Vessel Code; Section I, Power Boilers

ASME BPV II Pt C	(1998) Boiler and Pressure Vessel Code; Section II, Materials, Part C - Specifications for Welding Rods, Electrodes and Filler Metals
ASME BPV V	(1998) Boiler and Pressure Vessel Code; Section V, Nondestructive Examination
ASME BPV IX	(1998) Boiler and Pressure Vessel Code; Section IX, Welding and Brazing Qualifications

#### AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(1998) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS A3.0	(1994) Standard Welding Terms and Definitions
AWS B2.1	(1998) Welding Procedure and Performance Qualification
AWS QC1	(1996) AWS Certification of Welding Inspectors
AWS Z49.1	(1999) Safety in Welding and Cutting and Allied Processes

### 1.2 DEFINITIONS

Definitions shall be in accordance with AWS A3.0.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-02 Shop Drawings

Pressure Piping; GA-AO

Detail drawings showing location, length, and type of welds; and indicating postweld heat treatment and NDE as required.

#### SD-07 Certificates

Qualifications



Welder and welding operator performance qualification certificates. Welding inspectors and NDE personnel certificates. Qualifications of testing laboratory or the Contractor's quality assurance organization.

#### 1.4 GENERAL REQUIREMENTS

This section covers the welding of pressure piping systems specifically including pump station piping. Deviations from applicable codes, approved procedures, and approved detail drawings will not be permitted without prior written approval. Materials or components with welds made offsite will not be accepted if the welding does not conform to the requirements of this specification, unless otherwise specified. Procedures shall be developed by the Contractor for welding all metals included in the work. Welding shall not be started until welding procedures, welders, and welding operators have been qualified. Qualification testing shall be performed by an approved testing laboratory, or by the Contractor if approved by the Contracting Officer. Costs of such testing shall be borne by the Contractor. The Contracting Officer shall be notified at least 24 hours in advance of the time and place of the tests. When practicable, the qualification tests shall be performed at or near the worksite. The Contractor shall maintain current records of the test results obtained in the welding procedure, welding operator, welder performance qualifications, and nondestructive examination (NDE) procedures readily available at the site for examination by the Contracting Officer. Unless otherwise specified, the choice of welding process shall be the responsibility of the Contractor.

#### 1.5 PERFORMANCE

The Contractor shall be responsible for the quality of all joint preparation, welding, and examination. All materials used in the welding operations shall be clearly identified and recorded. The inspection and testing defined in this specification are minimum requirements. Additional inspection and testing shall be the responsibility of the Contractor when he deems it necessary to achieve the quality required.

#### 1.6 QUALIFICATIONS

Welding procedures, welders, and welding operators previously qualified by test may be accepted for the work without requalification, provided that all of the following conditions are fulfilled:

- a. Copies of the welding procedures, and the welder and welding operator performance qualification test records are submitted and approved in accordance with paragraph SUBMITTALS.
- b. Testing was performed by an approved testing laboratory or technical consultant or by the Contractor's approved quality assurance organization.
- c. The requirements of paragraph "Renewal of Qualification" below are met and records showing name of employer and period of employment using the process for which qualified are submitted as evidence of

conformance.

#### 1.6.1 Welding Procedures Qualification

The Contractor shall record in detail and shall qualify the Welding Procedure Specifications for every proposed pressure pipeage welding procedure. Qualification for each welding procedure shall conform to the requirements of this specification. The welding procedures shall specify end preparation for butt welds including cleaning, alignment, and root openings. Preheat, interpass temperature control, and postheat treatment of welds shall be as required by approved welding procedures, unless otherwise indicated or specified. The type of backing rings or consumable inserts, if used, shall be described and if they are to be removed, the removal process shall be described. Copies of the welding procedure specifications and procedure qualification test results for each type of welding required shall be submitted in accordance with paragraph SUBMITTALS. Approval of any procedure does not relieve the Contractor of the sole responsibility for producing acceptable welds. Welding procedures shall be identified individually and shall be referenced on the detail drawings or keyed to the contract drawings.

#### 1.6.2 Certification

Before assigning welders or welding operators to the work, the Contractor shall provide the Contracting Officer with their names together with certification that each individual is performance-qualified as specified. The certification shall state the type of welding and positions for which each is qualified, the code and procedure under which each is qualified, date qualified, and the firm and individual certifying the qualification test.

#### 1.6.3 Inspection and NDE Personnel

All inspection and NDE personnel shall be qualified in accordance with the following requirements.

##### 1.6.3.1 Inspector Certification

Welding inspectors shall be qualified in accordance with AWS QC1.

##### 1.6.3.2 NDE Personnel

NDE personnel shall be certified, and a written procedure for the control and administration of NDE personnel training, examination, and certification shall be established.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

All filler metals, electrodes, fluxes, and other welding materials shall be delivered to the site in manufacturers' original packages and stored in a dry space until used. Packages shall be properly labeled and designed to give maximum protection from moisture and to insure safe handling.

##### 1.7.1 Material Control

Materials shall be stored in a controlled access and clean, dry area that is weathertight and is maintained at a temperature recommended by the manufacturer. The materials shall not be in contact with the floor and shall be stored on wooden pallets or cribbing.

#### 1.7.1.1 Damaged Containers

Low-hydrogen steel electrodes shall be stored in their sealed shipping container. If the seal is damaged during shipment or storage, and the damage is not immediately detected, the covered electrodes in that container shall be rebaked in accordance with the manufacturer's instructions prior to issuance or shall be discarded. If a container is damaged in storage and the damage is witnessed, the electrodes from that container shall be immediately placed in a storage oven. The storage oven temperature shall be as recommended by the manufacturer or the welding material specification.

#### 1.7.1.2 Partial Issues

When a container of covered electrodes is opened and only a portion of the content is issued, the remaining portion shall, within 1/2 hour, be placed in a storage oven.

#### 1.7.2 Damaged Materials

Materials which are damaged shall be discarded. Covered electrodes which are oil or water-soaked, dirty, or on which the flux has separated from the wire shall be discarded.

### 1.8 SYMBOLS

Symbols shall be in accordance with AWS A2.4.

### 1.9 SAFETY

Safety precautions shall conform to AWS Z49.1.

## PART 2 PRODUCTS

### 2.1 WELDING MATERIALS

Welding equipment, electrodes, welding wire, and fluxes shall be capable of producing satisfactory welds when used by a qualified welder or welding operator using qualified welding procedures.

## PART 3 EXECUTION

### 3.1 WELDING OPERATIONS

Welding shall be performed in accordance with qualified procedures using qualified welders and welding operators. Welding shall not be done when the quality of the completed weld could be impaired by the prevailing working or weather conditions. The Contracting Officer shall determine when weather or working conditions are unsuitable for welding.

### 3.1.1 Base Metal Preparation

Oxy-fuel cutting shall not be used on austenitic stainless steel or nonferrous materials.

### 3.1.2 Weld Joint Fit-Up

Parts that are to be joined by welding shall be fitted, aligned, and retained in position during the welding operation by the use of bars, jacks, clamps, or other mechanical fixtures. Welded temporary attachments shall not be used except when it is impractical to use mechanical fixtures. When temporary attachments are used, they shall be the same material as the base metal, and shall be completely removed by grinding or thermal cutting after the welding operation is completed. If thermal cutting is used, the attachment shall be cut to not less than 6 mm from the member and the balance removed by grinding. After the temporary attachment has been removed, the area shall be visually examined.

### 3.1.3 Preheat and Interpass Temperatures

Preheat temperatures shall meet the requirements specified by ASME B31.1, ASME B31.3, ASME B31.4, ASME B31.5, ASME B31.8. However, in no case shall the preheat be below 10 degrees C for ferritic steel or austenitic stainless steel, or 0 degrees C for nonferrous alloys. The maximum interpass temperatures shall not exceed 149 degrees C for austenitic stainless steels, nickel alloys, and copper alloys; and 260 degrees C for carbon steels. Preheat techniques shall be such as to ensure that the full thickness of the weld joint preparation and/or adjacent base material, at least 75 mm in all directions, is at the specified temperature. Preheating by induction or resistance methods is preferred. When flame heating is used, only a neutral flame shall be employed. Oxy-fuel heating shall not be used on austenitic stainless steel or nickel-alloy materials; however, air-fuel heating is acceptable if controlled to insure that the surface temperature does not exceed 66 degrees C. Interpass temperatures shall be checked on the surface of the component within 25 mm of the weld groove and at the starting location of the next weld pass, and for a distance of about 150 mm ahead of the weld, but not on the area to be welded.

### 3.1.4 Production Welding Instructions

- a. Welding shall not be done when the ambient temperature is lower than -18 degrees C.
- b. Welding is not permitted on surfaces that are wet or covered with ice, when snow or rain is falling on the surfaces to be welded, or during periods of high winds, unless the welders and the work are properly protected.
- c. Gases for purging and shielding shall be welding grade and shall have a dew point of minus 40 degrees C or lower.
- d. Any welding process which requires the use of external gas shielding shall not be done in a draft or wind unless the weld area is

protected by a shelter. This shelter shall be of material and shape appropriate to reduce wind velocity in the vicinity of the weld to a maximum of 8 km per hour (5 mph).

- e. Welding of low-alloy and hardenable high-alloy steels may be interrupted provided a minimum of at least 10 mm thickness of weld deposit or 25 percent of the weld groove is filled, whichever is greater, and the preheat temperature is maintained during the time that welding is interrupted. If the temperature falls below the minimum preheat temperature before all welding has been completed on a joint, or, where required, before post weld heat treatment, a liquid penetrant or magnetic particle examination shall be performed to insure sound deposited metal before reheating. Welding of other materials may be interrupted without restriction provided a visual inspection is performed before welding is resumed.
- f. Tack welds to be incorporated in the final welds shall have their ends tapered by grinding or welding technique. Tack welds that are cracked or defective shall be removed and the groove shall be retacked prior to welding. Temporary tack welds shall be removed, the surface ground smooth, and visually inspected. For low-alloy and hardenable high-alloy steels, the area shall be magnetic particle examination inspected.

### 3.2 EXAMINATIONS, INSPECTIONS, AND TESTS

Visual and NDE shall be performed by the Contractor] to detect surface and internal discontinuities in completed welds. The services of a qualified commercial inspection or testing laboratory or technical consultant, approved by the Contracting Officer, shall be employed by the Contractor. All tack welds, weld passes, and completed welds shall be visually inspected. In addition, liquid penetrant examination shall be performed on root passes. Radiographic Liquid penetrant or Ultrasonic examination shall be required as indicated in TABLE I. When inspection and testing indicates defects in a weld joint, the weld shall be repaired by a qualified welder in accordance with paragraph CORRECTIONS AND REPAIRS.

TABLE I. MANDATORY MINIMUM NONDESTRUCTIVE EXAMINATIONS

Type Weld	Piping Service Conditions and Nondestructive Test		
	Temperatures over 400 degrees C and at all pressures.	Temperatures between 177 degrees C and 400 degrees C inclusive and at pressures above 7100 kPa.	All others.
Butt Welds (Girth and Longitudinal)	RT for NPS over 50 mm MT or PT for NPS 50 mm and less.	RT for over 50 mm NPS with thickness over 20 mm. Visual for all	Visual for all sizes and thicknesses.

TABLE I. MANDATORY MINIMUM NONDESTRUCTIVE EXAMINATIONS

Type Weld	Piping Service Conditions and Nondestructive Test sizes with thickness 20 mm or less.		
Welded Branch Connections (Size indicated is branch size) (See Note 7)	RT for NPS over 100 mm MT or PT for NPS 100 mm and less.	RT for branch over 100 mm NPS and thickness of branch over 20 mm inch. Visual for all sizes with branch thickness 20 mm or less.	Visual for all sizes and thicknesses.
Fillet, Socket Attachment and Seal Welds	PT or MT for all sizes and thicknesses.	Visual for all sizes and thicknesses.	Visual for all sizes and thicknesses.

## NOTES TO TABLE I

(1) All welds must be given a visual examination in addition to type of specific nondestructive examination specified.

(2) NPS - nominal pipe size.

(3) RT - Radiographic examination; MT - magnetic particle examination; PT - liquid penetrant examination.

(4) RT of branch welds shall be performed before any nonintegral reinforcing material is applied.

(5) The thickness of butt welds is defined as the thicker of the two abutting ends after end preparation.

(6) Temperatures and pressures shown are design.

(7) In lieu of radiography of welded branch connections when required above, liquid penetrant examination is acceptable and, when used, shall be performed at the lesser of one half of the weld thickness or each 13 mm of weld thickness and all accessible final weld surfaces.

(8) For nondestructive examination of the pressure retaining component, refer to the standards listed in applicable code or the manufacturing specifications.

(9) Fillet welds not exceeding 6 mm throat thickness which are used for the permanent attachment of nonpressure retaining parts are

exempt from the PT requirements of the above table.

### 3.2.1 Random NDE Testing

When random radiographic liquid penetrant or ultrasonic examination is required, the Contractor shall test a minimum of 20 percent of the total length or number of piping welds. The welds inspected shall be selected randomly, but the selection shall include an examination of welds made by each welding operator or welder. If the random testing reveals that any welds fail to meet minimum quality requirements, an additional 20 percent of the welds in that same group shall be inspected. If all of the additional welds inspected meet the quality requirements, the entire group of welds represented shall be accepted and the defective welds shall be repaired. If any of the additional welds inspected also fail to meet the quality requirements, that entire group of welds shall be rejected. The rejected welds shall be removed and rewelded, or the rejected welds shall be 100 percent inspected and all defective weld areas removed and rewelded.

### 3.2.2 Visual Inspection

Weld joints shall be inspected visually as follows:

- a. Before welding - for compliance with requirements for joint preparation, placement of backing rings or consumable inserts, alignment and fit-up, and cleanliness.
- b. During welding - for cracks and conformance to the qualified welding procedure.
- c. After welding - for cracks, contour and finish, bead reinforcement, undercutting, overlap, and size of fillet welds.

### 3.2.3 NDE Testing

NDE shall be in accordance with written procedures. Procedures for radiographic liquid penetrant or ultrasonic tests and methods shall generally conform to ASME BPV V. The approved procedure shall be demonstrated to the satisfaction of the Contracting Officer.

### 3.2.4 Inspection and Tests by the Government

The Government will perform inspection and supplemental nondestructive or destructive tests as deemed necessary. The cost of supplemental NDE will be borne by the Government. The correction and repair of defects and the reexamination of weld repairs shall be performed by the Contractor at no additional cost to the Government. Inspection and tests will be performed as required for visual inspection and NDE, except that destructive tests may be required also. When destructive tests are ordered by the Contracting Officer and performed by the Contractor and the specimens or other supplemental examinations indicate that the materials and workmanship do not conform to the contract requirements, the cost of the tests, corrections, and repairs shall be borne by the Contractor. When the specimens or other supplemental examinations of destructive tests indicate that materials or workmanship do conform to the specification requirements, the cost of the

tests and repairs will be borne by the Government. When destructive tests are made, repairs shall be made by qualified welders or welding operators using welding procedures which will develop the full strength of the members cut. Welding shall be subject to inspection and tests in the mill, shop, and field. When materials or workmanship do not conform to the specification requirements, the work may be rejected at any time before final acceptance of the system containing the weldment.

### 3.3 ACCEPTANCE STANDARDS

#### 3.3.1 Visual

The following indications are unacceptable:

- a. Cracks.
- b. Undercut on surface which is greater than 1 mm deep.
- c. Weld reinforcement greater than 5 mm.
- d. Lack of fusion on surface.
- e. Incomplete penetration (applies only when inside surface is readily accessible).
- f. Convexity of fillet weld surface greater than 10 percent of longest leg plus 0.76 mm.
- g. Concavity in groove welds.
- h. Concavity in fillet welds greater than 2 mm.
- i. Fillet weld size less than indicated or greater than 1-1/4 times the minimum indicated fillet leg length.

#### 3.3.2 Liquid Penetrant Examination

Indications with major dimensions greater than 2 mm shall be considered relevant. The following relevant indications are unacceptable:

- a. Any cracks or linear indications.
- b. Rounded indications with dimensions greater than 5 mm.
- c. Four or more rounded indications in a line separated by 2 mm or less edge-to-edge.
- d. Ten or more rounded indications in any 3870 square mm (6 square inches) of surface with the major dimension of this area not to exceed 150 mm with the area taken in the most unfavorable location relative to the indications being evaluated.

#### 3.3.3 Radiography



Welds that are shown by radiography to have any of the following discontinuities are unacceptable:

- a. Porosity in excess of that shown as acceptable in ASME BPV I, Appendix A-250.
- b. Any type of crack or zone of incomplete fusion or penetration.
- c. Any other elongated indication which has a length greater than:
  - (1) 6 mm for t up to 19 mm inclusive, where t is the thickness of the thinner portion of the weld.
  - (2)  $1/3$  t for t from 19 mm to 57 mm, inclusive.
  - (3) 19 mm for t over 57 mm.
- d. Any group of indications in line that have an aggregate length greater than t in a length of 12t, except where the distance between the successive indications exceeds 6L where L is the longest indication in the group.

Where t pertains to the thickness of the weld being examined; if a weld joins two members having different thickness at the weld, t is the thinner of these two thicknesses.

#### 3.3.4 Ultrasonic Examination

Linear-type discontinuities are unacceptable if the amplitude exceeds the reference level and discontinuities have lengths which exceed the following:

- a. 6 mm for t up to 19 mm.
- b. 8 mm for t from 19 to 57 mm.
- c. 19 mm for t over 57 mm.

Where t is the thickness of the weld being examined; if the weld joins two members having different thicknesses at the weld, t is the thinner of these two thicknesses. Where discontinuities are interpreted to be cracks, lack of fusion, and incomplete penetration, they are unacceptable regardless of length.

#### 3.4 CORRECTIONS AND REPAIRS

Defects shall be removed and repaired. Disqualifying defects discovered between weld passes shall be repaired before additional weld material is deposited. Wherever a defect is removed, and repair by welding is not required, the affected area shall be blended into the surrounding surface eliminating sharp notches, crevices, or corners. After defect removal is complete and before rewelding, the area shall be examined by the same test method which first revealed the defect to ensure that the defect has been eliminated. After rewelding, the repaired area shall be reexamined by the same test method originally used for that area. Any indication of a defect

shall be regarded as a defect unless reevaluation by NDE or by surface conditioning shows that no disqualifying defects are present. The use of any foreign material to mask, fill in, seal, or disguise welding defects will not be permitted.

-- End of Section --

## SECTION 05120

## STRUCTURAL STEEL

**09/97**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC FCD	(1995a) Quality Certification Program Description
AISC ASD Manual	(1989) Manual of Steel Construction Allowable Stress Design
AISC ASD/LRFD Vol II	(1992) Manual of Steel Construction Vol II: Connections
AISC Design Guide No. 10	(1989) Erection Bracing of Low-Rise Structural Steel Frames
AISC LRFD Vol I	(1995) Manual of Steel Construction Load & Resistance Factor Design, Vol I: Structural Members, Specifications & Codes
AISC LRFD Vol II	(1995) Manual of Steel Construction Load & Resistance Factor Design, Vol II: Structural Members, Specifications & Codes
AISC Pub No. S303	(1992) Code of Standard Practice for Steel Buildings and Bridges

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 6/A 6M	(1998a) General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
ASTM A 36/A 36M	(1997a) Carbon Structural Steel
ASTM A 53	(1999) Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A 242/A 242M	(1998) High-Strength Low-Alloy Structural Steel

ASTM A 307	(1997) Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength
ASTM A 325	(1997) Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 325M	(1997) High-Strength Bolts for Structural Steel Joints (Metric)
ASTM A 490	(1997) Heat-Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength
ASTM A 490M	(1993) High-Strength Steel Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints (Metric)
ASTM A 500	(1999) Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 501	(1999) Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
ASTM A 502	(1993) Steel Structural Rivets
ASTM A 514/A 514M	(1994a) High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding
ASTM A 529/A 529M	(1996) High-Strength Carbon-Manganese Steel of Structural Quality
ASTM A 563	(1997) Carbon and Alloy Steel Nuts
ASTM A 563M	(1997) Carbon and Alloy Steel Nuts (Metric)
ASTM A 572/A 572M	(1999) High-Strength Low-Alloy Columbium-Vanadium Structural Steel
ASTM A 588/A 588M	(1997) High-Strength Low-Alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point to 4 in. (100 mm) Thick
ASTM A 618	(1999) Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
ASTM A 709/A 709M	(1997a) Carbon and High-Strength Low-Alloy Structural Steel Shapes, Plates, and Bars and Quenched-and-Tempered Alloy Structural Steel Plates for Bridges
ASTM A 852/A 852M	(1997) Quenched and Tempered Low-Alloy Structural Steel Plate with 70 ksi (485 MPa) Minimum Yield Strength to 4 in. (100 mm) Thick

ASTM A 992/A 992M	(1998e1) Steel for Structural Shapes For Use in Building Framing
ASTM F 436	(1993) Hardened Steel Washers
ASTM F 436M	(1993) Hardened Steel Washers (Metric)
ASTM F 844	(1998) Washers, Steel, Plain (Flat), Unhardened for General Use
ASTM F 959	(1999) Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners

#### AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.21.1	(1994) Lock Washers (Inch Series)
ASME B46.1	(1995) Surface Texture (Surface Roughness, Waviness, and Lay)

#### AMERICAN WELDING SOCIETY (AWS)

AWS A2.4	(1998) Standard Symbols for Welding, Brazing and Nondestructive Examination
AWS D1.1	(1998) Structural Welding Code - Steel

#### STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 25	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (without Lead and Chromate Pigments)
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### 1.2 GENERAL REQUIREMENTS

Structural steel fabrication and erection shall be performed by an organization experienced in structural steel work of equivalent magnitude. The Contractor shall be responsible for correctness of detailing, fabrication, and for the correct fitting of structural members. Connections, for any part of the structure not shown on the contract drawings, shall be considered simple shear connections and shall be designed and detailed in accordance with pertinent provisions of AISC ASD Manual and AISC LRFD Vol II. Substitution of sections or modification of connection details will not be accepted unless approved by the Contracting Officer. AISC ASD Manual and AISC ASD/LRFD Vol II shall govern the work. Welding shall be in accordance with AWS D1.1; except that welding for critical applications shall be in accordance with Section 05090 WELDING, STRUCTURAL or paragraph WELDING. High-strength bolting shall be in accordance with AISC ASD Manual.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation;

submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-01 Preconstruction Submittals

##### Erection

Prior to erection, erection plan of the structural steel framing describing all necessary temporary supports, including the sequence of installation and removal.

Welding; GA-BK, GA-CH, GA-DN, GA-HQ

WPS not prequalified.

Welding

WPS prequalified.

#### SD-02 Shop Drawings

Structural Steel System; GA-BK, GA-CH, GA-DN, GA-HQ. Structural Connections ; GA-BK, GA-CH, GA-DN, GA-HQ

Shop and erection details including members (with their connections) not shown on the contract drawings. Welds shall be indicated by standard welding symbols in accordance with AWS A2.4.

#### SD-04 Samples

High Strength Bolts and Nuts Carbon Steel Bolts and Nuts Nuts Dimensional Style Washers

Random samples of bolts, nuts, and washers as delivered to the job site if requested, taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

#### SD-07 Certificates

##### Mill Test Reports

Certified copies of mill test reports for structural steel, structural bolts, nuts, washers and other related structural steel items, including attesting that the structural steel furnished contains no less than 25 percent recycled scrap steel and meets the requirements specified, prior to

the installation.

#### Welder Qualifications

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.1.

#### Welding Inspector

Welding Inspector qualifications.

Fabrication; GA-BK, GA-CH, GA-DN, GA-HQ

A copy of the AISC certificate indicating that the fabrication plant meets the specified structural steelwork category.

### 1.4 STORAGE

Material shall be stored out of contact with the ground in such manner and location as will minimize deterioration.

### 1.5 WELDING INSPECTOR

Welding Inspector qualifications shall be in accordance with AWS D1.1

## PART 2 PRODUCTS

### 2.1 STRUCTURAL STEEL

#### 2.1.1 Carbon Grade Steel

Carbon grade steel shall conform to ASTM A 36/A 36M.

#### 2.1.2 High-Strength Low-Alloy Steel

High-strength low-alloy steel shall conform to ASTM A 572/A 572M, Grade 345.

#### 2.1.3 Quenched and Tempered Alloy Steel

Tempered alloy steel shall conform to ASTM A 514/A 514M.

#### 2.1.4 Carbon and High-Strength Low-Alloy Steel

Carbon and high-strength low-alloy steel shall conform to ASTM A 709/A 709M.

#### 2.1.5 Quenched and Tempered Low-Alloy Steel

Quenched and tempered low-alloy steel shall conform to ASTM A 852/A 852M, 485 MPa.

#### 2.1.6 Structural Shapes for Use in Building Framing

Wide flange shapes in accordance with ASTM A 992/A 992M shall be used where indicated on the drawings.

## 2.2 STRUCTURAL TUBING

Structural tubing shall conform to ASTM A 500, Grade B.

## 2.3 STEEL PIPE

Steel pipe shall conform to ASTM A 53, Type E OR S, Grade B.

## 2.4 HIGH STRENGTH BOLTS AND NUTS

High strength bolts shall conform to ASTM A 325M , Type 1 with carbon steel nuts conforming to ASTM A 563M , Grade C.

## 2.5 CARBON STEEL BOLTS AND NUTS

Carbon steel bolts shall conform to ASTM A 307, Grade A with carbon steel nuts conforming to ASTM A 563M , Grade A.

## 2.6 NUTS DIMENSIONAL STYLE

Carbon steel nuts shall be Heavy Hex style when used with ASTM A 307 bolts or Heavy Hex style when used with ASTM A 325M or ASTM A 490M bolts.

## 2.7 WASHERS

Plain washers shall conform to ASTM F 844. Other types, when required, shall conform to ASTM F 436M.

## 2.8 PAINT

Paint shall conform to SSPC Paint 25.

# PART 3 EXECUTION

## 3.1 FABRICATION

Fabrication shall be in accordance with the applicable provisions of AISC ASD Manual. Fabrication and assembly shall be done in the shop to the greatest extent possible. The fabricating plant shall be certified under the AISC FCD for Category A structural steelwork. Compression joints depending on contact bearing shall have a surface roughness not in excess of 13 micrometer as determined by ASME B46.1, and ends shall be square within the tolerances for milled ends specified in ASTM A 6/A 6M. Structural steelwork, except surfaces of steel to be encased in concrete, surfaces to be field welded, surfaces to be fireproofed, and contact surfaces of friction-type high-strength bolted connections shall be prepared for painting in accordance with endorsement "P" of AISC FCD and primed with the specified paint.

## 3.2 ERECTION

- a: Erection of structural steel, except as indicated in item b. below, shall be in accordance with the applicable provisions of AISC ASD



Manual. Erection plan shall be reviewed, stamped and sealed by a structural engineer licensed by the state in which the project is located.

- b. For low-rise structural steel buildings (18 m tall or less and a maximum of 2 stories), the erection plan shall conform to AISC Pub No. S303 and the structure shall be erected in accordance with AISC Design Guide No. 10.

### 3.2.1 Structural Connections

Anchor bolts and other connections between the structural steel and foundations shall be provided and shall be properly located and built into connecting work. Field welded structural connections shall be completed before load is applied.

### 3.2.2 Base Plates and Bearing Plates

Column base plates for columns and bearing plates for beams, girders, and similar members shall be provided. Base plates and bearing plates shall be provided with full bearing after the supported members have been plumbed and properly positioned, but prior to placing superimposed loads. Separate setting plates under column base plates will not be permitted. The area under the plate shall be damp-packed solidly with bedding mortar, except where nonshrink grout is indicated on the drawings. Bedding mortar and grout shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

### 3.2.3 Field Priming

After erection, the field bolt heads and nuts, field welds, and any abrasions in the shop coat shall be cleaned and primed with paint of the same quality as that used for the shop coat.

## 3.3 WELDING

The contractor shall develop and submit the Welding Procedure Specifications (WPS) for all welding, including welding done using prequalified procedures.

Prequalified procedures may be submitted for information only; however, procedures that are not prequalified shall be submitted for approval.

## 3.4 SPECIAL INSPECTION AND TESTING FOR SEISMIC-RESISTING SYSTEMS

Special inspections and testing for seismic-resisting systems and components shall be done in accordance with Section 01452 SPECIAL INSPECTION FOR SEISMIC-RESISTING SYSTEMS.

-- End of Section --

## SECTION 05210

## STEEL JOISTS

11/88

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## STEEL JOIST INSTITUTE (SJI)

SJI Specs & Tables	(1994) Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Steel Joists; GA-BK, GA-CH, GA-DN, GA-HQ

Detail drawings shall include fabrication and erection details, specifications for shop painting, and identification markings of joists.

## SD-07 Certificates

Steel Joists

Certificates stating that the steel joists have been designed and manufactured in accordance with SJI Specs & Tables. Complete engineering design computations may be submitted in lieu of the certification.

## 1.3 DESCRIPTION

Steel joists are designated on the drawings in accordance with the standard designations of the Steel Joist Institute. Joists of other standard designations or joists with properties other than those shown may be substituted for the joists designated provided the structural properties are equal to or greater than those of the joists shown and provided all other

specified requirements are met.

#### 1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition and stored off the ground in a well drained location, protected from damage, and easily accessible for inspection and handling.

### PART 2 PRODUCTS

#### 2.1 OPEN WEB STEEL JOISTS

Open web steel joists shall conform to SJI Specs & Tables, K-Series. Joists shall be designed to support the loads given in the standard load tables of SJI Specs & Tables.

#### 2.2 JOIST GIRDERS

Joist girders shall conform to SJI Specs & Tables.

#### 2.3 ACCESSORIES AND FITTINGS

Accessories and fittings, including end supports and bridging, shall be in accordance with the standard specifications under which the members were designed.

#### 2.4 SHOP PAINTING

Joists and accessories shall be shop painted with a rust-inhibiting primer paint. For joists which will be finish painted under Section 09900 PAINTING, GENERAL, the primer paint shall be limited to a primer which is compatible with the specified finish paint.

### PART 3 EXECUTION

#### 3.1 ERECTION

Installation of joists shall be in accordance with the standard specification under which the member was produced. Joists shall be handled in a manner to avoid damage. Damaged joists shall be removed from the site, except when field repair is approved and such repairs are satisfactorily made in accordance with the manufacturer's recommendations. Joists shall be accurately set, and end anchorage shall be in accordance with the standard specification under which the joists were produced. For spans over 12 m through 18 m one row of bridging nearest midspan shall be bolted diagonal bridging; for spans over 18 m bolted diagonal bridging shall be used instead of welded horizontal bridging. Joist bridging and anchoring shall be secured in place prior to the application of any construction loads. Any temporary loads shall be distributed so that the carrying capacity of any joist is not exceeded. Loads shall not be applied to bridging during construction or in the completed work. Abraded, corroded, and field welded areas shall be cleaned and touched up with the same type of paint used in the shop painting.

#### 3.2 BEARING PLATES

Bearing plates shall be provided with full bearing after the supporting members have been plumbed and properly positioned, but prior to placing superimposed loads. The area under the plate shall be damp-packed solidly with bedding mortar, except where nonshrink grout is indicated on the drawings. Bedding mortar and grout shall be as specified in Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE.

-- End of Section --

## SECTION 05300

## STEEL DECKING

**10/89**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC ASD Spec (1989) Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Mn1 (1996) Cold-Formed Steel Design Manual

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 108 (1995) Steel Bars, Carbon, Cold Finished, Standard Quality

ASTM A 570/A 570M (1996) Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality

ASTM A 611 (1997) Structural Steel (SS), Sheet, Carbon, Cold-Rolled

ASTM A 653/A 653M (1997) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 780 (1993a) Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings

ASTM A 792/A 792M (1997) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

ASTM C 423 (1990a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

ASTM E 795 (1993) Mounting Test Specimens During Sound Absorption Tests

## AMERICAN WELDING SOCIETY (AWS)

AWS D1.1 (1998) Structural Welding Code - Steel

AWS D1.3 (1998) Structural Welding Code - Sheet Steel

#### STEEL DECK INSTITUTE (SDI)

SDI Diaphragm Mnl (1987; Amended 1991) Diaphragm Design Manual

SDI Pub No 29 (1995) Design Manual for Composite Decks, Form Decks, Roof Decks, and Cellular Metal Floor Deck with Electrical Distribution

#### STEEL STRUCTURES PAINTING COUNCIL (SSPC)

SSPC Paint 20 (1991) Zinc-Rich Primers (Type I - Inorganic and Type II - Organic)

### 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-03 Product Data

Deck Units; GA-BK, GA-CH, GA-DN, GA-HQ

Design computations for the structural properties of the deck units or SDI certification that the units are designed in accordance with SDI specifications.

#### SD-02 Shop Drawings

Deck Units; GA-BK, GA-CH, GA-DN, GA-HQ. Accessories; GA-BK, GA-CH, GA-DN, GA-HQ. Attachments; GA-BK, GA-CH, GA-DN, GA-HQ. Holes and Openings; GA-BK, GA-CH, GA-DN, GA-HQ.

Drawings shall include type, configuration, structural properties, location, and necessary details of deck units, accessories, and supporting members; size and location of holes to be cut and reinforcement to be provided; location and sequence of welded or fastener connections; and the manufacturer's erection instructions.

#### SD-07 Certificates

Deck Units Attachments

Manufacturer's certificates attesting that the decking material meets the specified requirements. Manufacturer's certificate attesting that the operators are authorized to use the low-velocity piston tool.

## Welder qualifications

Prior to welding operations, copies of qualified procedures and lists of names and identification symbols of qualified welders and welding operators.

### 1.3 DELIVERY, STORAGE, AND HANDLING

Deck units shall be delivered to the site in a dry and undamaged condition, stored off the ground with one end elevated, and stored under a weathertight covering permitting good air circulation. Finish of deck units shall be maintained at all times by using touch-up paint whenever necessary to prevent the formation of rust.

## PART 2 PRODUCTS

### 2.1 DECK UNITS

Deck units shall conform to SDI Pub No 29. Panels of maximum possible lengths shall be used to minimize end laps. Deck units shall be fabricated in lengths to span 3 or more supports with flush, telescoped, or nested 50 mm laps at ends, and interlocking, or nested side laps, unless otherwise indicated. Deck with cross-sectional configuration differing from the units indicated may be used, provided that the properties of the proposed units, determined in accordance with AISI Cold-Formed Mnl, are equal to or greater than the properties of the units indicated and that the material will fit the space provided without requiring revisions to adjacent materials or systems.

#### 2.1.1 Roof Deck

Steel deck used in conjunction with insulation and built-up roofing shall conform to ASTM A 792/A 792M, ASTM A 611 or ASTM A 792/A 792M. Roof deck units shall be fabricated of the steel design thickness required by the design drawings and shall be galvanized.

#### 2.1.2 Composite Deck

Deck to receive concrete as a filler or for composite deck assembly shall conform to ASTM A 653/A 653M or ASTM A 611. Deck used as the tension reinforcing in composite deck shall be fabricated of the steel design thickness required by the design drawings, and shall be zinc-coated in conformance with ASTM A 653/A 653M, G60 coating class. Deck units used in composite deck shall have adequate embossment to develop mechanical shear bond to provide composite action between the deck and the concrete.

#### 2.1.3 Form Deck

Deck used as a permanent form for concrete shall conform to ASTM A 653/A 653M or ASTM A 611. Deck used as a form for concrete shall be fabricated of the steel design thickness required by the design drawings, and shall be zinc-coated in conformance with ASTM A 653/A 653M, G60 coating class.

### 2.2 TOUCH-UP PAINT

Touch-up paint for shop-painted units shall be of the same type used for the shop painting, and touch-up paint for zinc-coated units shall be an approved galvanizing repair paint with a high-zinc dust content. Welds shall be touched-up with paint conforming to SSPC Paint 20 in accordance with ASTM A 780. Finish of deck units and accessories shall be maintained by using touch-up paint whenever necessary to prevent the formation of rust.

## 2.3 ADJUSTING PLATES

Adjusting plates or segments of deck units shall be provided in locations too narrow to accommodate full-size units. As far as practical, the plates shall be the same thickness and configuration as the deck units.

## 2.4 CLOSURE PLATES

### 2.4.1 Closure Plates for Roof Deck

Voids above interior walls shall be closed with sheet metal where shown. Open deck cells at parapets, end walls, eaves, and openings through roofs shall be closed with sheet metal. Sheet metal shall be same thickness as deck units.

### 2.4.2 Closure Plates for Composite Deck

The concrete shall be supported and retained at each floor level. Provide edge closures at all edges of the slab of sufficient strength and stiffness to support the wet concrete. Metal closures shall be provided for all openings in composite steel deck 6 mm and over, including but not limited to:

#### 2.4.2.1 Cover Plates to Close Panels

Cover plates to close panel edge and end conditions and where panels change direction or abut. Butt joints in composite steel deck may receive a tape joint cover.

#### 2.4.2.2 Column Closures to Close Openings

Column closures to close openings between steel deck and structural steel columns.

#### 2.4.2.3 Sheet Metal

Where deck is cut for passage of pipes, ducts, columns, etc., and deck is to remain exposed, provide a neatly cut sheet metal collar to cover edges of deck. Do not cut deck until after installation of supplemental supports.

## 2.5 ACCESSORIES

The manufacturer's standard accessories shall be furnished as necessary to complete the deck installation. Metal accessories shall be of the same material as the deck and have minimum design thickness as follows: saddles, 1.204 mm welding washers, 1.519 mm cant strip, 0.749 mm other metal accessories, 0.909 mm unless otherwise indicated. Accessories shall include but not be limited to saddles, welding washers, cant strips, butt cover



plates, underlapping sleeves, and ridge and valley plates.

### PART 3 EXECUTION

#### 3.1 ERECTION

Erection of deck and accessories shall be in accordance with SDI Pub No 29 and SDI Diaphragm Mnl and the approved detail drawings. Damaged deck and accessories including material which is permanently stained or contaminated, with burned holes or deformed shall not be installed. The deck units shall be placed on secure supports, properly adjusted, and aligned at right angles to supports before being permanently secured in place. The deck shall not be filled with concrete, used for storage or as a working platform until the units have been secured in position. Shoring shall be in position before concrete placement begins in composite or form deck. Loads shall be distributed by appropriate means to prevent damage during construction and to the completed assembly. The maximum uniform distributed storage load shall not exceed the design live load. There shall be no loads suspended directly from the steel deck.

#### 3.2 SHORING

Shoring requirements for placing and curing of concrete in the composite floor deck assemblies shall be as shown.

#### 3.3 WELDER QUALIFICATIONS

All fasteners shall be installed in accordance with the manufacturer's recommended procedure, except as otherwise specified. The deck units shall be welded with nominal 16 mm diameter puddle welds or fastened with screws, powder-actuated fasteners or pneumatically driven fasteners to supports as indicated on the design drawings and in accordance with requirements of SDI Pub No 29. All welding of steel deck shall be in accordance with AWS D1.3 using methods and electrodes as recommended by the manufacturer of the steel deck being used. Welds shall be made only by operators previously qualified by tests prescribed in AWS D1.3 to perform the type of work required. Welding washers shall be used at the connections of the deck to supports. Welding washers shall not be used at sidelaps. Holes and similar defects will not be acceptable. Deck ends shall be lapped 50 mm. All partial or segments of deck units shall be attached to structural supports in accordance with Section 2.5 of SDI Diaphragm Mnl.

#### 3.4 HOLES AND OPENINGS

All holes and openings required shall be coordinated with the drawings, specifications, and other trades. Holes and openings shall be drilled or cut, reinforced and framed as indicated on the drawings or described in the specifications and as required for rigidity and load capacity. Holes and openings less than 150 mm across require no reinforcement. Holes and openings 150 to 300 mm across shall be reinforced by 1.204 mm thick steel sheet at least 300 mm wider and longer than the opening and be fastened to the steel deck at each corner of the sheet and at a maximum of 150 mm on center. Holes and openings larger than 300 mm shall be reinforced by steel angles installed perpendicular to the steel joists and supported by the

adjacent steel joists. Steel angles shall be installed perpendicular to the deck ribs and shall be fastened to the angles perpendicular to the steel joists. Openings must not interfere with seismic members such as chords and drag struts.

### 3.5 PREPARATION OF FIRE-PROOFED SURFACES

Deck surfaces, both composite and noncomposite, which are to receive sprayed-on fireproofing, shall be galvanized and shall be free of all grease, mill oil, paraffin, dirt, salt, and other contaminants which impair adhesion of the fireproofing. Any required cleaning shall be done prior to steel deck installation using a cleaning method that is compatible with the sprayed-on fireproofing.

-- End of Section --

SECTION 05400  
COLD-FORMED STEEL FRAMING  
**03/99**

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Spec	(1996) Specification & Commentary for the Design of Cold-Formed Steel Structural Members (Part V of the Cold-Formed Steel Design Manual)
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AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123/A 123M	(1997a <sup>el</sup> ) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 153/A 153M	(1998) Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A 370	(1997a) Mechanical Testing of Steel Products
ASTM A 653/A 653M	(1999) Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 633	(1985; R 1998) Electrodeposited Coatings of Zinc on Iron and Steel
ASTM C 955	(1998) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
ASTM C 1007	(1998 <sup>el</sup> ) Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories
ASTM E 329	(1998) Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

AMERICAN WELDING SOCIETY (AWS)

AWS D1.3	(1998) Structural Welding Code - Sheet Steel
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## SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE J 78

(1998) Steel Self Drilling Tapping Screws

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

Cold-Formed Steel Framing; GA-BK, GA-DN, GA-HQ

- a. Cross sections, plans, and/or elevations showing component types and locations for each framing application; including shop coatings and material thicknesses for each framing component.
- b. Connection details showing fastener type, quantity, location, and other information to assure proper installation.
- c. Drawings depicting panel configuration, dimensions, components, locations, and construction sequence if the Contractor elects to install prefabricated/prefinished frames.

## SD-07 Certificates

## Mill Certificates

Mill certificates or test reports from independent testing agency, qualified in accordance with ASTM E 329, showing that the steel sheet used in the manufacture of each cold-formed component complies with the minimum yield strengths and uncoated steel thickness specified. Test reports shall be based on the results of three coupon tests in accordance with ASTM A 370.

## Welding Certificates

Certified copies of welder qualifications test records showing qualification in accordance with AWS D1.3.

## 1.3 DELIVERY, HANDLING AND STORAGE

Materials shall be delivered and handled preventing bending or other damage, and avoiding contact with soil or other contaminating materials. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content, galvanizing repair paint whenever necessary to prevent the formation of rust.

## PART 2 PRODUCTS

## 2.1 STEEL STUDS, TRACKS, AND ACCESSORIES

Framing components shall comply with ASTM C 955 and the following:

- a. Material shall be corrosion-resistant steel complying with ASTM A 653/A 653M, Grade 230 or higher, having a minimum yield of 340 MPa and a G 60 minimum zinc coating.
- b. Minimum uncoated steel thickness (design thickness times 0.95):
  - (1). Bracing and bridging: Thickness as shown on the drawings.
  - (2). Accessories: Standard thickness as provided by the manufacturer.
- c. Stud and Track web depth: 90, 100, 150, 200 and 250 300 mm.
- d. Stud flange width: 51 and 63 mm.
- e. Stud Properties: "C"-Shaped Studs Manufacturer's standard steel studs of size and shape indicated on drawings.

## 2.2 MARKINGS

Studs and track shall have product markings on the web of the section. The markings shall be repeated throughout the length of the member at a maximum spacing of 1200 mm on center and shall be legible and easily read. The product marking shall include the following:

- a. Manufacturer's identification.
- b. Minimum delivered uncoated steel thickness.
- c. Protective coating designator.
- d. Minimum yield strength.

## 2.3 CONNECTIONS

Attach components by welding. Secure cold formed metal framing to supporting structure as indicated on the drawings. All welded connections shall be designed and all welding shall be performed in accordance with AWS D1.3, as modified by AISI SG-671.

## PART 3 EXECUTION

### 3.1 Delivery, Handling and Storage

- a. Materials shall be delivered and handled in a manner to avoid bending or other damage and to avoid contact with the soil or other contaminating materials.
- b. Finish of the framing members shall be maintained at all times, using an approved high zinc dust content galvanizing repair paint whenever necessary to prevent the formation of rust.

### 3.2 CONNECTIONS

#### 3.2.1 Welds

All welding shall be performed in accordance with AWS D1.3, as modified by AISI Cold-Formed Spec. All welders, welding operations, and welding procedures shall be qualified according to AWS D1.3. All welds shall be cleaned and coated with rust inhibitive galvanizing paint.

#### 3.2.2 Anchors

Anchors shall be of the type, size, and location shown on the drawings.

### 3.3 INSTALLATION

#### 3.3.1 General Requirements

- a. Prefabricated frames shall be square, with components attached to prevent racking during fabrication, transportation, and lifting. Design and construction of frames shall include provisions for lifting.
- b. Cutting of steel framing shall be by saw, shear, or plasma cutting equipment. Oxyacetylene torch cutting is not permitted.
- c. Temporary bracing shall be provided and remain in place until work is permanently stabilized.
- d. Abutting lengths of track shall be butt-welded, spliced, or each length securely anchored to a common structural element. Track shall be securely anchored to the supporting structure as shown on the drawings.
- e. Splicing of framing components, other than track and tension members, is not permitted.
- f. Wire tying of framing members is not permitted.
- g. Secure studs to top and bottom runner tracks by welding at both inside and outside flanges.

#### 3.3.2 Non-Load Bearing Walls (Curtain walls)

- a. Studs shall be spaced as shown on drawings.
- b. Studs shall be plumbed, aligned, and secured to the continuous runner tracks at each end, unless the stud end terminates at a deflection track.
- c. Tracks shall be securely anchored to the supporting structure as shown on the drawings.
- d. Framed wall openings shall include headers and supporting components as shown on the drawings. Headers shall be installed in all

openings that are larger than the stud spacing in a wall.

- e. At wall openings for doors, windows and other similar features, the framing system shall provide for the installation and anchorage of the required subframes or finish frames. Steel frames shall be securely attached through built-in anchors to the nearest stud on each side of the opening with self-drilling screws. Double studs shall be provided at both jambs of all door openings.
- f. Installation of sheathing, wallboards, or any other collateral material shall be performed in accordance with the product manufacturer's specifications.
- g. Components (Deflection Track and Slide Clips) shall be provided at locations shown on the drawings to accommodate potential movements of Primary Frames. Construction shall accommodate a vertical movement of 12 mm.

#### 3.4 TOLERANCES

Vertical alignment (plumbness) of studs shall be within 1/960th of the span.

Horizontal alignment (levelness) of walls shall be within 1/960th of their respective lengths. Spacing of studs shall not be more than plus 3 mm from the designed spacing providing the the cumulative error does not exceed the requirements of the finishing material.

-- End of Section --

## SECTION 05500

## MISCELLANEOUS METAL

07/97

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1997) Designation System for Aluminum Finishes

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A14.3 (1992) Ladders - Fixed - Safety Requirements

ANSI MH28.1 (1982) Design, Testing, Utilization, and  
Application of Industrial Grade Steel Shelving

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M (1997ael) Carbon Structural Steel

ASTM A 53 (1999b) Pipe, Steel, Black and Hot-Dipped,  
Zinc-Coated, Welded and Seamless

ASTM A 123/A 123M (1997ael) Zinc (Hot-Dip Galvanized) Coatings  
on Iron and Steel Products

ASTM A 283/A 283M (1998) Low and Intermediate Tensile Strength  
Carbon Steel Plates

ASTM A 467/A 467M (1998) Machine and Coil Chain



ASTM A 475	(1998)	Zinc-Coated Steel Wire Strand
ASTM A 500	(1999)	Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
ASTM A 653/A 653M	(1999)	Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 924/A 924M	(1999)	General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM B 26/B 26M	(1998)	Aluminum-Alloy Sand Castings
ASTM B 221	(1996)	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 221M	(1996)	Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM B 429	(1995)	Aluminum-Alloy Extruded Structural Pipe and Tube
ASTM D 2047	(1993)	Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine
ASTM F 1267	(1997)	Metal, Expanded, Steel

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(1995)	Minimum Design Loads for Buildings and Other Structures
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AMERICAN WELDING SOCIETY (AWS)

AWS D1.1	(1998)	Structural Welding Code - Steel
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COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-344	(Rev B)	Lacquer, Clear Gloss, Exterior, Interior
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NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MBG 531	(1994)	Metal Bar Grating Manual
NAAMM MBG 532	(1994)	Heavy Duty Metal Bar Grating Manual

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 211	(1996; Errata 96-1)	Chimneys, Fireplaces, Vents and Solid Fuel-Burning Appliances
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

### SD-02 Shop Drawings

Miscellaneous Metal Items; GA-BK, GA-CH, GA-DN, GA-HQ

Detail drawings indicating material thickness, type, grade, and class; dimensions; and construction details. Drawings shall include catalog cuts, erection details, manufacturer's descriptive data and installation instructions, and templates. Detail drawings for the following items:

- Access doors and panels
- Chimneys and vents
- Pipe door stops
- Downspout boots
- Expansion joint covers
- Floor gratings and frames
- Handrails
- Ships ladder and safety railing
- Mirror frames
- Wire mesh partitions
- Roof scuttles
- Safety nosing
- Steel stairs
- Steel door frames

## 1.3 GENERAL REQUIREMENTS

The Contractor shall verify all measurements and shall take all field measurements necessary before fabrication. Welding to or on structural steel shall be in accordance with AWS D1.1. Items specified to be galvanized, when practicable and not indicated otherwise, shall be hot-dip galvanized after fabrication. Galvanizing shall be in accordance with ASTM A 123/A 123M, ASTM A 653/A 653M, or ASTM A 924/A 924M, as applicable. Exposed fastenings shall be compatible materials, shall generally match in color and finish, and shall harmonize with the material to which fastenings are applied. Materials and parts necessary to complete each item, even though such work is not definitely shown or specified, shall be included. Poor matching of holes for fasteners shall be cause for rejection. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall provide strength and stiffness. Joints exposed to the weather shall be formed to exclude water.

## 1.4 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, or where aluminum is in contact with concrete, mortar, masonry, wet or pressure-treated wood, or absorptive materials subject to wetting, the surfaces shall be protected with a coat of

bituminous paint or asphalt varnish.

#### 1.5 WORKMANSHIP

Miscellaneous metalwork shall be well formed to shape and size, with sharp lines and angles and true curves. Drilling and punching shall produce clean true lines and surfaces. Welding shall be continuous along the entire area of contact except where tack welding is permitted. Exposed connections of work in place shall not be tack welded. Exposed welds shall be ground smooth. Exposed surfaces of work in place shall have a smooth finish, and unless otherwise approved, exposed riveting shall be flush. Where tight fits are required, joints shall be milled. Corner joints shall be coped or mitered, well formed, and in true alignment. Work shall be accurately set to established lines and elevations and securely fastened in place. Installation shall be in accordance with manufacturer's installation instructions and approved drawings, cuts, and details.

#### 1.6 ANCHORAGE

Anchorage shall be provided where necessary for fastening miscellaneous metal items securely in place. Anchorage not otherwise specified or indicated shall include slotted inserts made to engage with the anchors, expansion shields, and power-driven fasteners when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; and lag bolts and screws for wood.

#### 1.7 ALUMINUM FINISHES

Unless otherwise specified, aluminum items shall have anodized finished. The thickness of the coating shall be not less than that specified for protective and decorative type finishes for items used in interior locations or architectural Class I type finish for items used in exterior locations in AA DAF-45. Aluminum surfaces to be in contact with plaster or concrete during construction shall be protected with a field coat conforming to CID A-A-344.

#### 1.8 SHOP PAINTING

Surfaces of ferrous metal except galvanized surfaces, shall be cleaned and shop coated with the manufacturer's standard protective coating unless otherwise specified. Surfaces of items to be embedded in concrete shall not be painted. Items to be finish painted shall be prepared according to manufacturer's recommendations or as specified.

### PART 2 PRODUCTS

#### 2.1 ACCESS DOORS AND PANELS

Doors and panels shall be flush type unless otherwise indicated. Frames for access doors shall be fabricated of not lighter than 1.52 mm (16 gauge) steel with welded joints and finished with anchorage for securing into construction. Access doors shall be a minimum of 300 by 300 mm and of not lighter than 1.9 mm (14 gauge) steel, with stiffened edges, complete with attachments. Access doors shall be hinged to frame and provided with a

flush face, screw driver operated latch. Exposed metal surfaces shall have a shop applied prime coat.

## 2.2 CHIMNEYS AND VENTS

Chimneys and vents shall be designed and constructed in accordance with NFPA 211. Chimney connectors shall be formed of not lighter than 1.01 mm (20 gauge) galvanized steel. Seams and joints shall be welded, except that an angle flange shall be provided for connection to the boiler, other equipment, and support.

## 2.3 PIPE DOOR STOPS

Pipe door stops shall be heavy duty steel pipe conforming to ASTM A 53/A 53M. Type E or S, weight STD, black finish. Steel pipe shall be filled with concrete and shall have a smooth finished dome to shed water. Provide a neoprene sleeve bumper that shall have a 70 durometer hardness as produced by Indiana Rubber and Plastics Co. or equal, and must be adhered to the steel pipe to prevent removal. A 100 mm steel eyebolt with a steel hook shall be mounted on the pipe and a staple plate with hook shall be mounted on the door with 4 screws, acting as the door holder.

## 2.4 DOWNSPOUT BOOTS

Downspout boots shall be cast iron with receiving bells sized to fit downspouts.

## 2.5 EXPANSION JOINT COVERS

Expansion joint covers shall be constructed of extruded aluminum with anodized satin finish for walls and ceilings and with standard mill finish for floor covers and exterior covers. Plates, backup angles, expansion filler strip and anchors shall be designed as indicated. Expansion joint system shall provide a 1 hour fire rating and 50 mm movement.

## 2.6 FLOOR GRATINGS AND FRAMES

Carbon steel grating shall be designed in accordance with NAAMM MBG 531 to meet the indicated load requirements. Edges shall be banded with bars 6 mm less in height than bearing bars for grating sizes above 19 mm. Banding bars shall be flush with the top of bearing grating. Frames shall be of welded steel construction finished to match the grating. Floor gratings and frames shall be galvanized after fabrication.

## 2.7 HANDRAILS

Handrails shall be designed to resist a concentrated load of 890 N in any direction at any point of the top of the rail or 292 Newtons per meter applied horizontally to top of the rail, whichever is more severe.

### 2.7.1 Steel Handrails, Including Carbon Steel Inserts

Steel handrails, including inserts in concrete, shall be steel pipe conforming to ASTM A 53 or structural tubing conforming to ASTM A 500, Grade

A or B of equivalent strength. Steel railings shall be 50 mm nominal size. Railings shall be hot-dip galvanized and painted. Pipe collars shall be hot-dip galvanized steel or stainless steel as indicated.

- a. Joint posts, rail, and corners shall be fabricated by one of the following methods:

(1) Flush type rail fittings of commercial standard, welded and ground smooth with railing splice locks secured with 10 mm hexagonal recessed-head setscrews.

(2) Mitered and welded joints by fitting post to top rail and intermediate rail to post, mitering corners, groove welding joints, and grinding smooth. Railing splices shall be butted and reinforced by a tight fitting interior sleeve not less than 150 mm long.

(3) Railings may be bent at corners in lieu of jointing, provided bends are made in suitable jigs and the pipe is not crushed.

- b. Removable sections, toe-boards, and brackets shall be provided as indicated.

## 2.8 SHIPS LADDERS AND SAFETY RAILING

Ships ladder and safety railing shall be galvanized steel or aluminum fixed rail type in accordance with ANSI A 14.3. All wall and floor attachments shall be provided as part of the ladder construction. Rungs shall be no less than 32 mm in section formed from lublar aluminum extrusions, alloy 6063-T6 and shall be capable of withstanding a 1,000 pound load. Ships ladder shall have deeply serrated rungs no less than 32 mm high 100 mm deep and 600 mm long. Tread spacing shall be 300 mm on center and an angel of rise between 60 and 70 degrees. Railings shall extend no less than 1,066 mm above the floor above.

## 2.9 MIRROR FRAMES

Frames for plate glass mirrors larger than 450 by 750 mm shall be fabricated from extruded aluminum with anodized finish. Frames shall be provided with concealed fittings and tamperproof mountings.

## 2.10 MISCELLANEOUS

Miscellaneous plates and shapes for items that do not form a part of the structural steel framework, such as lintels, sill angles, miscellaneous mountings, and frames, shall be provided to complete the work.

## 2.11 PARTITIONS, DIAMOND MESH TYPE

Partitions shall be constructed of metal fabric attached to structural steel framing members. Fabric shall be 10 gauge steel wires woven into 38 mm diamond mesh with wire secured through weaving channels. Framing members shall be channels 38 by 3 mm minimum size. Channel frames shall be mortised and tenoned at intersections. Steel frames, posts, and intermediate members shall be of the sizes and shapes indicated. Cast-iron floor shoes and caps

shall have setscrew adjustment. Doors and grilles shall be provided as indicated, complete with hardware and accessories including sliding mechanisms, locks, guard plates, sill shelves and brackets, and fixed pin butts. Doors and grilles shall have cover plates as indicated. Dutch doors shall have a lock for each leaf. A continuous rubber bumper shall be provided at bottom of grille frame. Locks shall be bronze, cylinder, mortise type. Keying shall be coordinated with Section 08700 BUILDERS' HARDWARE. Ferrous metal portions of partitions and accessories shall be galvanized.

## 2.12 ROOF SCUTTLES

Roof scuttles shall be of galvanized steel not less than 2.0 mm (14 gauge), with 75 mm beaded flange welded and ground at corners. Scuttle shall be sized to provide minimum clear opening of 940 by 760 mm. Cover and curb shall be insulated with 25 mm thick rigid insulation covered and protected by galvanized steel liner not less than 0.55 mm (26 gauge). The curb shall be equipped with an integral metal cap flashing of the same gauge and metal as the curb, full welded and ground at corners for weathertightness. Scuttle shall be completely assembled with heavy hinges, compression spring operators enclosed in telescopic tubes, positive snap latch with turn handles on inside and neoprene draft seal. Fasteners shall be provided for padlocking on the inside. The cover shall be equipped with an automatic hold-open arm complete with handle to permit one hand release.

## 2.13 SAFETY NOSING

Safety nosings shall be of cast aluminum with diamond pattern, abrasive surface. Nosing shall be 75 mm wide and terminating at not more than 150 mm from the ends of treads. Safety nosings shall be provided with anchors not less than 19 mm long. Integrally cast mushroom anchors are not acceptable.

## 2.14 STEEL STAIRS

Steel stairs shall be complete with structural or formed channel stringers, landings, columns, handrails, and necessary bolts and other fastenings as indicated. Structural steel strength shall be as indicated on drawings. Stairs and accessories shall be galvanized. Risers on stairs with metal pan treads shall be deformed to form a sanitary cove to retain the tread concrete. Integral nosings shall have braces extended into the concrete fill.

## 2.15 STEEL DOOR FRAMES

Steel door frames built from structural shapes shall be neatly mitered and securely welded at the corners with all welds ground smooth. Jambs shall be provided with 50 by 6 by 300 mm bent, adjustable metal anchors spaced not over 760 mm on centers. Provision shall be made to stiffen the top member for all spans over 900 mm.

# PART 3 EXECUTION

## 3.1 GENERAL INSTALLATION REQUIREMENTS

All items shall be installed at the locations shown and according to the manufacturer's recommendations. Items listed below require additional procedures as specified.

### 3.2 REMOVABLE ACCESS PANELS

A removable access panel not less than 300 by 300 mm shall be installed directly below each valve, flow indicator, damper, or air splitter that is located above the ceiling, other than an acoustical ceiling, and that would otherwise not be accessible.

### 3.3 INSTALLATION OF CHIMNEYS AND VENTS

Chimneys and vents shall be installed in accordance with NFPA 211. Roof housing, rain cap, downdraft diverter, fire damper, and other accessories required for a complete installation shall be provided. Sections of prefabricated lined chimneys shall be joined with acid-resisting high-temperature cement and steel draw bands. Means to prevent accumulation of water in the chimney shall be provided.

### 3.4 INSTALLATION OF PIPE DOOR STOPS

Pipe door stops shall be set in concrete and filled with, concrete having a compressive strength of 21 MPa.

### 3.5 ATTACHMENT OF HANDRAILS

Toeboards and brackets shall be installed where indicated. Splices, where required, shall be made at expansion joints. Removable sections shall be installed as indicated.

#### 3.5.1 Installation of Steel Handrails

Installation shall be by means of pipe sleeves secured to concrete or masonry with expansion shields and bolts or toggle bolts. Rail ends shall be secured by steel pipe flanges anchored by expansion shields and bolts or through-bolted to a back plate or by 6 mm lag bolts to studs or solid backing.

### 3.6 INSTALLATION OF SAFETY NOSINGS

Nosing shall be completely embedded in concrete before the initial set of the concrete occurs and shall finish flush with the top of the concrete surface.

### 3.7 DOOR FRAMES

Door frames shall be secured to the floor slab by means of angle clips and expansion bolts. Any necessary reinforcements shall be made and the frames shall be drilled and tapped as required for hardware.

-- End of Section --

DIVISION 6 – WOODS AND PLASTICS

06100	Rough Carpentry
06410	Custom Casework



## SECTION 06100

## ROUGH CARPENTRY

**09/96**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN FOREST &amp; PAPER ASSOCIATION (AF&amp;PA)

- |           |   |
|-----------|---|
| AF&PA T01 | (1997; w/Supple T02) National Design<br>Specification for Wood Construction |
| AF&PA T11 | (1988) Manual for Wood Frame Construction                                   |

## AMERICAN HARDBOARD ASSOCIATION (AHA)

- |                     |                              |
|---------------------|------------------------------|
| AHA ANSI/AHA A135.4 | (1995) Basic Hardboard       |
| AHA A194.1          | (1985) Cellulosic Fiberboard |

## AMERICAN INSTITUTE OF TIMBER CONSTRUCTION (AITC)

- |                      |  |
|----------------------|--|
| AITC-01              | (1994) Timber Construction Manual  |
| AITC 109             | (1990) Standard for Preservative Treatment of<br>Structural Glued Laminated Timber   |
| AITC 111             | (1979) Recommended Practice for Protection of<br>Structural Glued Laminated Timber During<br>Transit, Storage and Erection |
| AITC ANSI/AITC-190.1 | (1992) Wood Products - Structural Glued<br>Laminated Timber  |

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- |             |                      |
|-------------|----------------------|
| ANSI A208.1 | (1993) Particleboard |
|-------------|----------------------|

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- |            |   |
|------------|---|
| ASTM A 307 | (1994) Carbon Steel Bolts and Studs, 60 000<br>PSI Tensile Strength |
| ASTM C 79  | (1995) Gypsum Sheathing Board                                       |

ASTM C 208	(1995) Cellulosic Fiber Insulating Board
ASTM C 516	(1980; R 1996) Vermiculite Loose Fill Thermal Insulation
ASTM C 518	(1991) Steady-State Heat Flux Measurements and Thermal Transmission Properties By Means of the Heat Flow Meter Apparatus
ASTM C 549	(1981; R 1995) Perlite Loose Fill Insulation
ASTM C 552	(1991) Cellular Glass Thermal Insulation
ASTM C 553	(1992) Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	(1994) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 612	(1993) Mineral Fiber Block and Board Thermal Insulation
ASTM C 665	(1995) Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C 726	(1993) Mineral Fiber Roof Insulation Board
ASTM C 739	(1991) Cellulosic Fiber (Wood-Base) Loose-Fill Thermal Insulation
ASTM C 764	(1994) Mineral Fiber Loose-Fill Thermal Insulation
ASTM C 1136	(1995) Flexible, Low Permeance Vapor Retarders for Thermal Insulation
ASTM C 1289	(1995) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D 2898	(1994) Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing
ASTM E 84	(1996a) Surface Burning Characteristics of Building Materials
ASTM E 96	(1995) Water Vapor Transmission of Materials
ASTM E 154	(1988; R 1993) Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on

Walls, or as Ground Cover

ASTM F 547 (1977; R 1990) Definitions of Terms Relating to Nails for Use with Wood and Wood-Base Materials

#### AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C2 (1995) Lumber, Timber, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes

AWPA C9 (1995) Plywood - Preservative Treatment by Pressure Processes

AWPA C20 (1993) Structural Lumber Fire-Retardant Pressure Treatment

AWPA C27 (1993) Plywood - Fire-Retardant Pressure Treatment

AWPA M4 (1995) Standard for the Care of Preservative-Treated Wood Products

AWPA P5 (1996) Standards for Waterborne Preservatives

#### APA - THE ENGINEERED WOOD ASSOCIATION (APA)

APA E30P (1996) Design/Construction Guide, Residential and Commercial

APA EWS R540C (1996) Builder Tips Proper Storage and Handling of Glulam Beams

APA EWS T300C (1997) Glulam Connection Details

APA PRP-108 (1994: Rev 1996) Performance Standards and Policies for Structural-Use Panels (Form No. E445Q)

#### CALIFORNIA REDWOOD ASSOCIATION (CRA)

CRA-01 (1997) Standard Specifications for Grades of California Redwood Lumber

#### CODE OF FEDERAL REGULATION (CFR)

16 CFR 1209 Interim Safety Standard for Cellulose Insulation

#### DEPARTMENT OF COMMERCE (DOC)

DOC PS 1 (1996) Voluntary Product Standard - Construction and Industrial Plywood

DOC PS 2 (1992) Performance Standards for Wood-Based  
Structural-Use Panels

FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM LPD 1-49 (1995) Loss Prevention Data Sheet - Perimeter  
Flashing

NATIONAL HARDWOOD LUMBER ASSOCIATION (NHLA)

NHLA-01 (1994) Rules for the Measurement & Inspection  
of Hardwood & Cypress

NORTHEASTERN LUMBER MANUFACTURERS ASSOCIATION (NELMA)

NELMA-01 (1997) Standard Grading Rules for Northeastern  
Lumber

SOUTHERN CYPRESS MANUFACTURERS ASSOCIATION (SCMA)

SCMA-01 (1986; Supple No. 1, Aug 1993) Standard  
Specifications for Grades of Southern Cypress

SOUTHERN PINE INSPECTION BUREAU (SPIB)

SPIB 1003 (1994; Supple 8 thru 11) Standard Grading  
Rules for Southern Pine Lumber

TRUSS PLATE INSTITUTE (TPI)

TPI 1 (1995) National Design Standard for Metal  
Plate-Connected Wood Truss Construction and  
Commentary and Appendices to TPI 1

TPI HIB-91 (1991) Handling, Installing & Bracing Metal  
Plate Connected Wood Trusses

WEST COAST LUMBER INSPECTION BUREAU (WCLIB)

WCLIB Std 17 (1996; Supples VII(A-E), VIII(A-C)) Grading  
Rules for West Coast Lumber

WESTERN WOOD PRODUCTS ASSOCIATION (WWPA)

WWPA-01 (1995; Supple Nos. 1 thru 5) Western Lumber  
Grading Rules 95

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-07 Certificates

## Grading and Marking

Manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material not normally grade marked meet the specified requirements. Certificate of Inspection for grade marked material by an American Lumber Standards Committee (ALSC) recognized inspection agency prior to shipment.

## Insulation

Certificate attesting that the mineral fiber, polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

## 1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in undamaged condition, stored off ground in fully covered, well ventilated areas, and protected from extreme changes in temperature and humidity. Laminated timber shall be handled and stored in accordance with AITC 111 or APA EWS R540C.

## PART 2 PRODUCTS

## 2.1 LUMBER AND SHEATHING

## 2.1.1 Grading and Marking

## 2.1.1.1 Lumber Products

Solid sawn and finger-jointed lumber shall bear an authorized gradestamp or grademark recognized by ALSC, or an ALSC recognized certification stamp, mark, or hammerbrand. Surfaces that are to be exposed to view shall not bear grademarks, stamps, or any type of identifying mark. Hammer marking will be permitted on timbers when all surfaces will be exposed to view.

## 2.1.1.2 Plywood and Other Sheathing Products

Materials shall bear the grademark or other identifying marks indicating grades of material and rules or standards under which produced, including requirements for qualifications and authority of the inspection organization. Except for plywood and structural-use panels, bundle marking will be permitted in lieu of marking each individual piece. Surfaces that are to be exposed to view shall not bear grademarks or other types of identifying marks.

## 2.1.2 Sizes

Lumber and material sizes shall conform to requirements of the rules or standards under which produced. Unless otherwise specified, lumber shall be surfaced on four sides. Unless otherwise specified, sizes indicated are

nominal sizes, and actual sizes shall be within manufacturing tolerances allowed by the standard under which the product is produced.

#### 2.1.3 Treatment

Exposed areas of treated wood that are cut or drilled after treatment shall receive a field treatment in accordance with AWPA M4. Items of all-heart material of cedar, cypress, or redwood will not require preservative treatment, except when in direct contact with soil. Except as specified for all-heart material of the previously mentioned species, the following items shall be treated:

- a. Wood members in contact with or within 455 mm of soil.
- b. Wood members in contact with water.
- c. Wood members exposed to the weather including those used in roofing systems.
- d. Wood members set into concrete regardless of location.
- e. Wood members in contact with concrete that is in contact with soil or water or that is exposed to weather.

##### 2.1.3.1 Lumber and Timbers

Lumber and timbers shall be treated in accordance with AWPA C2 with waterborne preservatives listed in AWPA P5 to a retention level as follows:

- a. 4 kg per cubic meter (0.25 pcf) intended for above ground use.
- b. 6.4 kg per cubic meter (0.40 pcf) intended for ground contact and fresh water use.

#### 2.1.4 Moisture Content

At the time lumber and other materials are delivered and when installed in the work their moisture content shall be as follows:

- a. Treated and Untreated Lumber. 100 mm or less, nominal thickness, 19 percent maximum. 125 mm or more, nominal thickness, 23 percent maximum in a 75 mm perimeter of the timber cross-section.
- b. Materials Other Than Lumber: In accordance with standard under which product is produced.

#### 2.1.5 Fire-Retardant Treatment

Fire-retardant treated wood shall be pressure treated in accordance with AWPA C20 for lumber and AWPA C27 for plywood. Material use shall be defined in AWPA C20 and AWPA C27 for Interior Type A. Treatment and performance inspection shall be by an independent and qualified testing agency that establishes performance ratings. Each piece or bundle of treated material shall bear identification of the testing agency to indicate performance in

accordance with such rating. Treated materials to be exposed to rain wetting shall be subjected to an accelerated weathering technique in accordance with ASTM D 2898 prior to being tested for compliance with AWPA C20 or AWPA C27. Items to be treated include: Plywood backing panels for electrical and communications equipment.

#### 2.1.6 Sheathing

Sheathing shall be gypsum board, for wall sheathing.

##### 2.1.6.1 Gypsum Board

Gypsum board shall conform to ASTM C 79, 13 mm thick (1/2 inch thick), 1200 mm wide with straight edges for supports 400 mm on center without corner bracing of framing or for supports 600 mm on center with corner bracing of framing; 600 mm wide with V-tongue and groove edges for supports 400 or 600 mm on center with corner bracing of framing.

#### 2.1.7 Miscellaneous Wood Members

##### 2.1.7.1 Nonstress Graded Members

Members shall include bridging, corner bracing, furring, grounds, and nailing strips. Members shall be in accordance with TABLE I for the species used. Sizes shall be as follows unless otherwise shown:

Member	Size mm (inch)
Bridging	25 x 75 (1 x 3) or 25 x 100 (1 x 4) for use between members 50 x 300 (2 x 12) and smaller; 50 x 100 (2 x 4) for use between members larger than 50 x 300 (2 x 12).
Corner bracing	25 x 100 (1 x 4).
Furring	25 (1) x 50 (2) 75 (3)
Nailing strips	25 x 75 (1 x 3) or 25 x 100 (1 x 4) when used as shingle base or interior finish, otherwise 50 mm (2 inch) stock.

##### 2.1.7.2 Blocking

Blocking shall be standard or number 2 grade.

#### 2.2 ACCESSORIES AND NAILS

Markings shall identify both the strength grade and the manufacturer. Accessories and nails shall conform to the following:

##### 2.2.1 Anchor Bolts

ASTM A 307, size as indicated, complete with nuts and washers.

#### 2.2.2 Bolts: Lag, Toggle, and Miscellaneous Bolts and Screws

Type, size, and finish best suited for intended use. Finish options include zinc compounds, cadmium, and aluminum paint impregnated finishes.

#### 2.2.3 Expansion Shields

Type and size best suited for intended use.

#### 2.2.4 Nails and Staples

ASTM F 547, size and type best suited for purpose; staples shall be as recommended by the manufacturer of the materials to be joined. For sheathing and subflooring, length of nails shall be sufficient to extend 25 mm into supports. In general, 8-penny or larger nails shall be used for nailing through 25 mm thick lumber and for toe nailing 50 mm thick lumber; 16-penny or larger nails shall be used for nailing through 50 mm thick lumber. Nails used with treated lumber and sheathing shall be galvanized. Nailing shall be in accordance with the recommended nailing schedule contained in AF&PA T11. Where detailed nailing requirements are not specified, nail size and spacing shall be sufficient to develop an adequate strength for the connection. The connection's strength shall be verified against the nail capacity tables in AF&PA T01. Reasonable judgement backed by experience shall ensure that the designed connection will not cause the wood to split. If a load situation exceeds a reasonable limit for nails, a specialized connector shall be used.

### 2.3 INSULATION

Thermal resistance of insulation shall be not less than the RSI-values shown. RSI-values shall be determined at 24 degrees C in accordance with ASTM C 518. Insulation shall contain the highest practicable percentage of recovered material which has been recovered or diverted from solid waste, but not including material reused in a manufacturing process. Where two materials have the same price and performance, the one containing the higher recovered material content shall be provided. Insulation shall be the standard product of a manufacturer and factory marked or identified with manufacturer's name or trademark and RSI-value. Identification shall be on individual pieces or individual packages. Materials containing more than one percent asbestos will not be allowed.

#### 2.3.1 Batt or Blanket

##### 2.3.1.1 Glass Fiber Batts and Rolls

Glass fiber batts and rolls shall conform to ASTM C 665, Type III foil faced insulation, Class A, having a UL rating of 25 and a smoke developed rating of 150 or less when tested in accordance with ASTM E 84. Width and length shall suit construction conditions.

#### 2.3.2 Sill Sealer



Mineral wool, 25 mm thick and compressible to 0.8 mm, width of sill, designed to perform as an air, dirt, and insect seal in conformance with ASTM C 665, Type I.

### 2.3.3 Rigid Insulation

#### 2.3.3.1 Polyurethane or Polyisocyanurate Board

Polyurethane or polyisocyanurate board shall have a minimum recovered material content of 9 percent by weight of core material in the polyurethane or polyisocyanurate portion. Unfaced preformed polyurethane shall conform to ASTM C 591. Faced polyisocyanurate shall conform to ASTM C 1289.

### 2.4 VAPOR RETARDER

Vapor retarder shall be polyethylene sheeting conforming to ASTM E 154 or other equivalent material. Vapor retarder shall have a maximum vapor permeance rating of 29 ng per Pa per second per square meter (0.5 perms) as determined in accordance with ASTM E 96, unless otherwise specified.

## PART 3 EXECUTION

### 3.1 INSTALLATION OF SHEATHING

#### 3.1.1 Gypsum Board

Sheathing shall be applied with edges in light contact at joints and nailed in accordance with the manufacturer's approved instructions. Sheets 600 mm wide shall be applied horizontally with tongued edge up, with vertical joints over supports, and with vertical joints staggered. Sheets 1200 mm wide shall be applied vertically, extended over top and bottom plates, and with all vertical and horizontal joints over supports.

### 3.2 INSTALLATION OF MISCELLANEOUS WOOD MEMBERS

#### 3.2.1 Blocking

Blocking shall be provided as necessary for application of siding, sheathing, subflooring, wallboard, and other materials or building items, and to provide firestopping. Blocking for firestopping shall ensure a maximum dimension of 2400 mm for any concealed space. Blocking shall be cut to fit between framing members and rigidly nailed thereto.

#### 3.2.2 Nailers and Nailing Strips

Nailers and nailing strips shall be provided as necessary for the attachment of finish materials. Nailers used in conjunction with roof deck installation shall be installed flush with the roof deck system. Stacked nailers shall be assembled with spikes or nails spaced not more than 450 mm on center and staggered. Beginning and ending nails shall not be more than 150 mm for nailer end. Ends of stacked nailers shall be offset approximately 300 mm in long runs and alternated at corners. Anchors shall extend through the entire thickness of the nailer. Strips shall be run in lengths as long as practicable, butt jointed, cut into wood framing members

when necessary, and rigidly secured in place. Nailers and nailer installation for Factory Mutual wind uplift rated roof systems specified in other Sections of these specifications shall conform to the recommendations contained in FM LPD 1-49.

### 3.2.3 Furring Strips

Furring strips shall be provided at the locations shown. Furring strips shall be installed at 400 mm on center unless otherwise shown, run in lengths as long as practicable, butt jointed and rigidly secured in place.

### 3.3 INSTALLATION OF INSULATION

Insulation shall be installed after construction has advanced to a point that the installed insulation will not be damaged by remaining work. For thermal insulation the actual installed thickness shall provide the thermal resistance shown. For acoustical insulation the installed thickness shall be as shown. Insulation shall be installed on the weather side of such items as electrical boxes and water lines. Unless otherwise specified, installation shall be in accordance with the manufacturer's recommendation.

### 3.4 INSTALLATION OF VAPOR RETARDER

Vapor retarder shall be applied to provide a continuous barrier at window and door frames, and at all penetrations such as electrical outlets and switches, plumbing connections, and utility service penetrations. Joints in the vapor retarder shall be lapped and sealed according to the manufacturer's recommendations.

### 3.5 PLYWOOD BACKING PANEL

Plywood backing panels for electrical and communications equipment shall be installed on two walls of rooms in which equipment is installed. Panels shall be given two coats of water-based, semi-gloss enamel paint. Color shall be white. -- End of Section --

## SECTION 06410

## CUSTOM CASEWORK

05/99

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI (7th Edition) (1997) Architectural Woodwork Quality Standards, Guide Specifications & Quality Certification Program

## AMERICAN NATIONAL STANDARD INSTITUTE/NATIONAL ELECTRICAL MFGRS ASSOC. (ANSI/NEMA)

ANSI/NEMA LD 3 (1995) Performance Standards for High Pressure Laminate

## AMERICAN NATIONAL STANDARD INSTITUTE (ANSI)

ANSI A-161.2 (1979) Fabrication Standards for High Pressure Laminates

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM F 547 (1977; R 1990) Definition of Terms Relating to Nails for Use with Wood and Wood-Base Materials.

## AMERICAN NATIONAL STANDARD INSTITUTE/BUILDERS HARDWARE MFGRS ASSOC. (ANSI/BHMA)

ANSI/BHMA A156.9 (1994) American National Standard for Cabinet Hardware

## 1.2 DEFINITION

The term "custom casework" as used herein includes the restroom vanities, all cabinets, work surfaces, and shelving as detailed and located on the drawings. Specifications include wood cabinets, high-pressure laminate surfacing and cabinet hardware. All exposed and semi-exposed surfaces, whose finish is not otherwise noted on the drawings or finish schedule, shall be sanded smooth and shall receive a clear finish of polyurethane. Wood finish may be shop finished or field applied in accordance with Section 09900: PAINTING, GENERAL. Solid polymer fabrications shall be constructed in accordance with SECTION 06650: SOLID POLYMER FABRICATIONS.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-02 Shop Drawings

Casework; GA-HQ, GA-DN, GA-BK.

Shop drawings shall show fabricated items and special mill and woodwork items. Shop drawings shall accurately indicate materials used, details of construction, dimensions, methods of fastening and erection, and installation methods proposed. Shop drawing casework items shall be clearly cross-referenced to casework items located on the project drawings. Shop drawings shall include a color schedule of all casework items to include all countertop, exposed, and semi-exposed cabinet finishes to include manufacturer, type pattern, and color.

#### SD-03 Product Data; GA-HQ, GA-DN, GA-BK.

Descriptive data shall be supplied which provides verification of all types of construction materials and finishes, methods of construction, etc. not clearly illustrated on the submitted shop drawings. Data shall provide written verification of conformance with all AWI standards listed in the specifications for materials, tolerances, and types of construction.

#### SD-04 Samples

Plastic laminate; GA-HQ, GA-DN, GA-BK.

Submit two samples of each plastic laminate pattern and color. Samples shall be a minimum of 120mm by 170mm in size.

Cabinet hardware; GA-HQ, GA-DN, GA-BK.

Submit one sample of each cabinet hardware item to include hinges, pulls, and drawer glides.

### 1.4 QUALITY ASSURANCE

Unless otherwise noted on the drawings, all materials, construction methods, and fabrication shall conform to the "premium grade" quality standards as outlined in AWI for laminate cabinets.

## 1.5 DELIVERY AND STORAGE

Casework may be delivered knockdown or fully assembled. All units shall be delivered to the site in undamaged condition, stored off the ground in fully enclosed areas, and protected from damage. The storage area shall be well ventilated and not subject to extreme changes in temperature or humidity. Do not store products in building until wet trade materials are dry. Moisture content of wood products at time of delivery to the job site shall be in accordance with the applicable standards.

## 1.6 FIELD MEASUREMENTS

Verify that field measurements are as indicated in the shop drawings before fabrication.

## 1.7 SCHEDULING AND COORDINATION

Coordinate work with other trades. Units shall not be installed in any room or space until painting, and ceiling installation are complete within the room where the units are located. Floor cabinets shall be installed before finished flooring materials are installed.

# PART 2 PRODUCTS

## 2.1 WOOD MATERIALS

### 2.1.1 CASEWORK

#### 2.1.1.1 Lumber

All 50 mm by 100 mm lumber framing shall be Grade III. Frame front shall be 19mm by 38mm inch hardwood. All drawer fronts and doors shall be 19mm particleboard.

#### 2.1.1.2 Plywood

All plywood panels used for framing purposes shall be AWI Grade I, A-A, in thickness of 6mm or 19mm as noted on the drawings. Drawer side and back assembly components shall be 13mm thickness, AWI Grade I, A-A hardwood veneer plywood. Drawer bottom shall be 6mm thickness, AWI Grade I, A-A hardwood veneer plywood.

### 2.1.2 Countertops and Backsplashes

#### 2.1.2.1 Solid Polymer Fabrication

All countertops and backsplashes shall be constructed of 13mm solid polymer material in dimensions as indicated on the drawings.

## 2.2 SOLID POLYMER MATERIAL

Solid polymer material used for countertops and integral backsplashes shall be 13mm in thickness and in locations as noted on the drawings and finish schedule. Color and pattern shall be as indicated on the Interior Finish

Materials Legend drawing. See SECTION 06650: SOLID POLYMER FABRICATIONS for material and fabrication specifications.

### 2.3 LAMINATE (PLASTIC)

All laminates shall meet the requirements of ANSI/NEMA LD3 and ANSI A161.2 for high-pressure decorative laminates. Design, colors, finish, and locations shall be as indicated on the drawings and on the Interior Finish Materials Legend drawing. Laminated cabinet interior surfaces shall utilize cabinet liner grade with a minimum thickness of 0.50mm. Bond laminated plastic under pressure to exposed surfaces, using type of glue recommended by laminated plastic manufacturer, and bond a backing sheet under pressure to underside of countertop. countertop unit shall be post-formed type with no-drip and 1/2 round bull nose, cove moulding, and style A backsplash, and covered with NEMA LD 3, Grade PF 42 Plastic.

### 2.4 CABINET HARDWARE

All hardware shall conform to ANSI/BHMA A.156.9 and shall consist of the following units:

- a. Door Hinges: Concealed, self-closing European-type (B01602) with a minimum 120 degree swing.
- b. Door/Drawer Pulls: Wire pulls shall be back mounted aluminum with satin finish. Dimensions shall be 7.94mm diameter extrusion by 102mm length and 50mm extension. Pull shall be equal to Stanley No. 4484US27.
- c. Drawer Slide: Side mounted (B05051) equal to Accuride model 3829 with full extension and a minimum 45kg load capacity.
- d. Adjustable Shelf Standards: Mortised (B04071), color: brushed chrome as noted on the drawings. Surface mounted standards or pinhole-type systems are not allowed.
- e. Shelf Rest: Closed version (B04081), color: brushed chrome as noted on the drawings.

### 2.5 FASTENERS

Nails, screws, and other suitable fasteners shall be the size and type best suited for the purpose and shall conform to ASTM F 547 where applicable.

### 2.6 ACCESSORIES

#### 2.6.1 Adhesives

Adhesives shall be of a formula and type recommended by the manufacturer of material to be adhered and consistent with materials to be adhered to.

##### 2.6.1.1 Wood Joinery

Adhesives used to bond wood members shall be a urea-formaldehyde resin

formula.

#### 2.6.1.2 Laminate Adhesive

Adhesive used to join high-pressure decorative laminate to wood shall be a contact adhesive as recommended by the laminate manufacturer.

### 2.7 FINISHES

Finishes and their applications shall be as indicated in Section 09900: PAINTING.

### 2.8 FABRICATION

#### 2.8.1 Cabinet Case Body

Cabinet construction shall be AWI "premium" grade, flush overlay as indicated on the drawings. Cabinets shall be constructed with 19mm frame fronts and 13mm plywood sides and interior partitions unless otherwise noted. Backs shall be 6mm plywood. Frame members shall be glued-together kiln-dried hardwood. Top corners, bottom corners, and cabinet bottoms shall be braced with either hardwood blocks that are glued together with water-resistant glue and nailed in place, or metal or plastic corner braces.

##### 2.8.1.1 Joinery

Joints shall be tight and constructed in a manner to conceal shrinkage. Miter trim and moldings at exterior angles and cope at interior finish angles and at returns. Material shall show no warp after installation.

##### a. Tops, Exposed Ends, and Bottoms

Method of joinery for case body members shall be limited to one of the following:

- (1) Steel "European" assembly screws (37mm from end, 128mm on center, fasteners will not be visible on exposed parts)
- (2) Doweled, glued under pressure (approx. 4 dowels per 300mm of joint)
- (3) Stop dado, glued under pressure, and either nailed, stapled or screwed (fasteners will not be visible on exposed parts) mortised and tenoned, dovetailed or doweled, and nailed, stapled, or screwed.

##### b. Exposed End Corner and Face Frame Attachment

Method of joinery shall be by mitered joint: lock miter or spline or biscuit, glued under pressure (no visible fasteners).

##### c. Cabinet Backs

Cabinet backs for wall-hung units shall be full bound, captured in grooves on cabinet sides, top, and bottom. Cabinet backs for floor standing cabinets shall be side bound, captured in grooves;

glued and fastened to top and bottom.

d. Wall Anchor Strips

Strips shall consist of minimum 13mm thick lumber, minimum 60mm width; securely attached to wall side of cabinet back - top and bottom for wall hung cabinets, top only for floor standing cabinets.

Wall hung cabinet backs must not be relied on to support full weight of cabinet and its anticipated load. Hanging/mounting mechanisms must transfer load to case body members.

2.8.1.2 Cabinet Door and Drawer Fronts

Door and drawer fronts shall be solid core wood flush doors, or be fabricated from 19mm medium density particleboard. All surfaces shall be laminated with matching general-purpose grade high-pressure laminate (HPL) for all face surfaces and edge banding. Interior door surfaces shall match vertical cabinet grade laminate as specified for adjacent interior cabinet surfaces. Colors and patterns shall be as noted on the drawings.

2.8.1.3 Drawer Assembly

Drawer components shall consist of a removable drawer front, sides, backs, and bottom. Sides, backs, and bottom shall high-pressure vertical or cabinet liner grade laminate adhered to 7-ply, hardwood veneer core substrate. Sides and backs shall be 13mm thick and bottom shall be 6mm thick. Laminate shall appear on all surfaces visible when drawer is in the full open position. Drawer bottoms shall be full bound, captured in 6mm deep grooves on all four drawer sides and backs with 9mm standing shoulder. Drawer sides and backs shall be joined together by dovetail joinery.

2.8.1.4 Shelving

Adjustable and fixed shelving shall be fabricated from 19mm medium density particleboard. Shelving shall be anchored to supporting construction. Unless otherwise noted, shelves shall be supported by wall-supported brackets not more than 600 mm between supports with a load 525 N. per meter.

Adjustable shelf hardware shall be steel standards, channel shaped, with 25 mm adjustable attachments to standards. Fixed shelving shall include laminated top and bottom surfaces and front edge banding. Laminate shall be general-purpose grade. All surfaces of adjustable shelving shall be laminated with matching general purpose grade high pressure laminate (HPL) for top and bottom faces and perimeter edge banding.

2.8.1.5 High Pressure Laminate

All exposed and semi-exposed cabinet surfaces as defined by AWI shall be solid core wood or covered with high pressure decorative laminate with the exception of the exterior face of toe space or as indicated on the drawings.

Apply required grade of laminate in full uninterrupted sheets consistent with manufactured sizes using one piece for full length only, using adhesives specified herein or as recommended by the manufacturer. Fit corners and joints hairline. Fabrication shall conform to ANSI A-161.2



a. Edge/Joint Quality

All laminate edges shall be machined flush, filed, sanded, or buffed to remove machine marks and eased (sharp corners removed). Clean up at easing shall be such that no overlap of the member eased is visible.

2.8.2 Tolerances

Fitting tolerances of doors and drawers, flatness of doors, flushness between assembled joints, and edge-banding tolerances shall conform to minimum requirements for AWI "premium grade" quality construction.

2.8.3 Finishing

2.8.3.1 Filling

No fasteners shall be exposed on laminated surfaces. All nails, screws, and other fasteners in non-laminated cabinet components shall be countersunk and the holes filled with wood filler consistent in color with the wood species.

2.8.3.2 Sanding

Prepare all surfaces requiring coatings by sanding with a grit and in a manner that scratches will not show in the final system.

2.8.3.3 Coatings

See the finish schedule, drawings and Section 09900: PAINT for types, method of application and location of casework finishes. All cabinet reveals shall be painted.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Countertops & Cabinets

Countertop and cabinet units shall be installed level, plumb, and true to line, in locations shown on the drawings. Units shall be attached securely to the floor and walls with anchoring devices that are appropriate for the wall and floor construction. Anchors shall be hidden from view. Comply with applicable requirements of AWI "premium" quality standards.

Countertops, hardware, and accessories shall be installed as indicated. Prior to final acceptance, doors shall be aligned, hardware adjusted, and units left in clean and neat condition.

3.1.2 Restroom Vanity

Verify adequacy of backing and wall support framing. Vanities shall be installed level, plumb, and true to line, in locations and at a height as shown on the drawings. The vanities shall be attached securely to the walls with anchoring devices and additional structural support that is appropriate for the wall construction and concealed from view. See SECTION 06650: SOLID

POLYMER FABRICATIONS for countertop and lavatory installation. Provide sealant or caulking at the juncture of the wall and countertop backsplash, clear in color. Caulking bead shall be smooth and of minimum size required to function properly and provide a smooth, finished appearance. Prior to final acceptance vanities shall be cleaned and left in neat condition.

-- End of Section --

DIVISION 7 – THERMAL AND MOISTURE PROTECTION

07220	Roof Insulation
07240	Exterior Insulation and Finish System
07416	Structural Standing Seam Metal Roof (SSSMR) System
07530	Elastomeric Roofing (EPDM)
07600	Sheet Metalwork, General
07840	Firestopping
07900	Joint Sealing

## SECTION 07220

ROOF INSULATION  
**05/96**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A208.1 (1993) Particleboard

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 208 (1995) Cellulosic Fiber Insulating Board

ASTM C 552 (1991) Cellular Glass Thermal Insulation

ASTM C 578 (1995) Rigid, Cellular Polystyrene Thermal Insulation

ASTM C 726 (1993) Mineral Fiber Roof Insulation Board

ASTM C 728 (1997) Perlite Thermal Insulation Board

ASTM C 1050 (1991) Rigid Cellular Polystyrene-Cellulosic Fiber Composite Roof Insulation

ASTM C 1289 (1995) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board

ASTM D 41 (1994) Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing

ASTM D 226 (1997) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing

ASTM D 312 (1995a) Asphalt Used in Roofing

ASTM D 2178 (1997) Asphalt Glass Felt Used in Roofing and Waterproofing

ASTM D 4586 (1993) Asphalt Roof Cement, Asbestos Free

ASTM D 4897 (1997) Asphalt-Coated Glass-Fiber Venting  
Base Sheet Used in Roofing

ASTM F 547 (1977; R 1990) Definitions of Terms Relating  
to Nails for Use with Wood and Wood-Base  
Materials

#### FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P9513 (1996) Loss Prevention Data for Roofing  
Contractors

FM P7825a (1998) Approval Guide Fire Protection

FM P7825c (1998) Approval Guide Building Materials

#### UNDERWRITERS LABORATORIES (UL)

UL Bld Mat Dir (1998) Building Materials Directory

### 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-07 Certificates

##### Insulation

Certificate attesting that the polyisocyanurate insulation contains recovered material and showing estimated percent of recovered material.

#### SD-08 Manufacturer's Instructions

Application of Insulation.

Insulation manufacturer's recommendations for the application and installation of insulation.

### 1.3 STORAGE OF MATERIALS

Insulation, base sheet, and felt shall be kept dry at all times, before, during, and after delivery to the site and shall be stored in an enclosed building or in a closed trailer. Wet insulation, shall be permanently removed from the site.

#### 1.4 FIRE CLASSIFICATION

Insulation shall have been tested as part of a roof construction assembly of the type used in this project and the construction shall be listed as Fire-Classified in UL Bld Mat Dir or Class I in FM P7825a, except for installation on poured concrete decks.

### PART 2 PRODUCTS

#### 2.1 INSULATION

Insulation shall be a standard product of the manufacturer and shall be factory marked with the manufacturer's name or trade mark, the material specification number, the R-value at 24 degrees C, and the thickness. Minimum thickness shall be as recommended by the manufacturer. Boards shall be marked individually. The thermal resistance of insulation shall be not less than the R-value shown on the drawings. The insulation manufacturing process shall not include chlorofluoro carbons (CFC) or formaldehydes. Insulation shall contain the highest practicable percentage of material which has been recovered or diverted from solid waste (e.g., postconsumer waste), but not including material reused in a manufacturing process. Where two materials have comparable price and performance, the one having the higher recovered material content shall be selected. Insulation shall be one, or a combination of the following materials:

##### 2.1.1 Polyisocyanurate

ASTM C 1289, Type I, or ASTM C 1289 Type II, having minimum recovered material content of 9 percent by weight of the polyisocyanurate portion of the board.

#### 2.2 NAILS AND FASTENERS

Nails and fasteners shall conform to the following requirements:

##### 2.2.1 Fasteners

Insulation manufacturer's recommendations except holding power, when driven, shall be not less than 178 N each in steel deck. Fasteners for steel or concrete decks shall conform to FM P7825c for Class I roof deck construction, and shall be spaced to withstand an uplift pressure of 2.87 kPa

##### 2.2.2 Metal Disks

Flat and not less than 0.39 mm (30 gauge) thickness. Disks used with nails or fasteners for securing board insulation shall be minimum 53 mm in diameter.

#### 2.3 WOOD NAILERS

Wood nailers shall conform to Section 06100 ROUGH CARPENTRY, including preservative treatment. Edge nailers shall be not less than nominal 150 mm

wide and of thickness to finish flush with the top surface of the insulation. Surface mounted nailers shall be a nominal 75 mm wide by the full thickness of the insulation.

### PART 3 EXECUTION

#### 3.1 COORDINATION REQUIREMENTS

Insulation and roofing membrane shall be finished in one operation up to the line of termination at the end of each day's work. Completed sections shall be waterproofed when more than one day is required to finish the roofing. Phased construction will not be permitted.

#### 3.2 ENVIRONMENTAL CONDITIONS

Air temperature shall be above 4 Degrees C and there shall be no visible ice, frost, or moisture on the roof deck when the insulation and roofing are installed.

#### 3.3 SUBSTRATE PREPARATION

The substrate construction of any bay or section of the building shall be completed before insulation or vapor retarder work is begun thereon. Vents and other items penetrating the roof shall be secured in position and properly prepared for flashing. Prior to application of vapor retarder or insulation, substrate joints shall be covered with a 100 mm strip of roofing felt, embedded in and coated with asphalt cement. Substrate surface shall be smooth, clean, and dry at time of application.

#### 3.4 INSTALLATION OF WOOD NAILERS

Nailers shall be secured to steel decks as indicated. Bolt anchors shall have nuts and washers countersunk, and bolts shall be cut flush with top of nailer. Powder-actuated fasteners, sized and spaced for nailer anchorage equivalent to that specified and indicated, may be used when approved. Surface mounted nailers shall be installed parallel with the roof slope and shall be spaced not over 1.2 meters face-to-face, except that where the insulation units are less than 1.2 meters in length the nailers shall be spaced to minimize cutting of the insulation.

#### 3.5 APPLICATION OF INSULATION

Insulation shall be laid in two or more layers. Units of insulation shall be laid in courses parallel with the roof slope. End joints shall be staggered. Insulation shall be cut to fit neatly against adjoining surfaces. Joints between insulation boards shall not exceed 6 mm. Joints in successive layers shall be staggered with respect to joints of preceding layer. Where insulation is applied over steel deck, long edge joints shall continuously bear on surfaces of the steel deck. Insulation which can be readily lifted after installation is not considered to be adequately secured. Insulation shall be applied so that all roof insulation applied each day is waterproofed the same day. Phased construction will not be permitted. Application of impermeable faced insulation shall be performed without damage to the facing.

### 3.5.1 Mechanical Fastening

On steel decks, or any slope exceeding 42 mm/m, the first layer of insulation shall be mechanically fastened. Method of attachment shall be in accordance with recommendations of the insulation manufacturer and requirements specified.

### 3.5.2 Steel Decks

Uninsulated steel decks shall have insulation applied to span the steel deck flutes and to act as an underlayment for the roof membrane. First layer of insulation on steel deck shall be compatible with mechanical fastening.

### 3.5.3 Installation

Except for the first layer on steel deck, insulation layers shall be laid in solid moppings of hot asphalt applied at a rate of at least 0.97 kg per meter (20 lbs per square). Asphalt shall not be applied further than one panel length ahead of roof insulation being installed. Where roof slopes are greater than 42 mm/m, roof insulation shall be held in place by both asphalt mopping and mechanical fasteners. The edges of insulation boards adjoining vented nailers shall be kept free of asphalt.

### 3.5.4 Protection Requirements

The insulation shall be kept dry at all times. Insulation boards shall not be kicked into position. Exposed edges of the insulation shall be protected by cutoffs at the end of each work day or whenever precipitation is imminent.

Cutoffs shall be removed when work is resumed. Edges of insulation at open spaces between insulation and parapets or other walls and spaces at curbs, scuttles, and expansion joints, shall be protected until permanent roofing and flashing is applied. Storing, walking, wheeling, or trucking directly on insulation or on roofed surfaces will not be permitted. Smooth, clean board or plank walkways, runways, and platforms shall be used, as necessary to distribute weight to conform to indicated live load limits of roof construction.

## 3.6 INSPECTION

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed roof insulation with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of insulation workers; start and end time of work.
- b. Verification of certification, listing or label compliance with FM P9513.
- c. Verification of proper storage and handling of insulation materials before, during, and after installation.



d. Inspection of mechanical fasteners; type, number, length, and spacing.

e. Coordination with other materials, cants, sleepers, and nailing strips.

f. Inspection of insulation joint orientation and laps between layers, joint width and bearing of edges of insulation on deck.

g. Installation of cutoffs and proper joining of work on subsequent days.

h. Continuation of complete roofing system installation to cover insulation installed same day.

-- End of Section --

## SECTION 07240

EXTERIOR INSULATION AND FINISH SYSTEM  
**06/93**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 117	(1995) Operating Salt Spray (Fog) Testing Apparatus
ASTM C 67	(1996) Sampling and Testing Brick and Structural Clay Tile
ASTM C 473	(1995) Physical Testing of Gypsum Board Products and Gypsum Lath
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 920	(1995) Elastomeric Joint Sealants
ASTM C 947	(1989; R 1996) Flexural Properties of Thin-Section Glass-Fiber-Reinforced Concrete (Using Simple Beam With Third-Point Loading)
ASTM C 948	(1981; R 1994) Dry and Wet Bulk Density, Water Absorption and Apparent Porosity of Thin Sections of Glass-Fiber-Reinforced Concrete
ASTM C 1149	(1990) Self-Supported Spray Applied Cellulosic Thermal/Acoustical Insulation, or Both
ASTM D 968	(1993) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D 2394	(1983; R 1993) Simulated Service Testing of Wood and Wood-Base Finish Flooring
ASTM E 72	(1995) Conducting Strength Tests of Panels for Building Construction
ASTM E 84	(1996) Surface Burning Characteristics of

## Building Materials

ASTM E 96	(1995) Water Vapor Transmission of Materials
ASTM E 136	(1995) Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C
ASTM E 330	(1990) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference
ASTM G 23	(1996) Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials
ASTM G 53	(1996) Operating Light- and Water-Exposure Apparatus (Fluorescent UV-Condensation Type) For Exposure of Nonmetallic Materials

## EIFS INDUSTRY MEMBERS ASSOCIATION (EIMA)

EIMA TM 101.86	(1995; Rev Aug 1995) Resistance of Exterior Insulation Finish Systems (EIFS), Class PB to The Effects of Rapid Deformation (Impact)
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## INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS (ICBO)

ICBO-01	(1997) Uniform Building Code (3 Vol.)
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## 1.2 DESCRIPTION

The exterior insulation and finish system (EIFS) shall be a job-fabricated exterior wall covering consisting of insulation, reinforcing fabric, base coat, finish coat, and accessories. The system shall be the standard product of a manufacturer regularly engaged in furnishing exterior insulation and finish systems and shall be installed by an applicator approved by the system manufacturer. EIFS shall be polymer base, Class PB and shall be Sandalwood Beige color and Sandpebble Finish.

## 1.3 PERFORMANCE REQUIREMENTS

## 1.3.1 Test Specimens

Unless otherwise noted, the test specimens shall consist of reinforcement, base coat and finish coat applied in accordance with the manufacturer's printed recommendations to an insulation board common to the system. These test specimens shall be suitably sized for the apparatus used and be allowed to cure for a minimum of 28 days prior to testing.

## 1.3.2 Flame Spread

Flame spread test samples consist of base coat, fabric and finish coat, mounted on a non-combustible substrate. When tested in accordance with ASTM E 84, the samples shall have a flame spread rating of 25 or less.

### 1.3.3 Full Scale Wall Fire Test

Full scale wall fire test specimens shall include the complete system with no less than 100 mm of insulation. Test shall be performed in accordance with ICBO-01, Section 17-6. The specimen shall not contribute to significant or horizontal flame spread.

### 1.3.4 Impact Test

The exterior insulation and finish system shall have been tested in accordance with EIMA TM 101.86 using a specimen consisting of cured finish system over 25 mm thick insulation with base coat and reinforcing fabric in a complete assembly typical of the project application. Specimen shall withstand an impact of 10-17 newton-meters. High impact resistance system shall be used at all locations within 2 mm of the ground.

### 1.3.5 Structural Performance Test

The system shall have been tested in accordance with ASTM E 330 to minimum positive and negative pressures of 1400 Pa. Test panels shall be 1.2 m by 1.2 m minimum, consisting of the typical system assembly.

## 1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-04 Samples

Exterior Insulation and Finish System; GA-BK, GA-CH, GA-DN, GA-HQ.

Two samples of each exterior insulation and finish system. Each sample shall be 300 mm square, minimum, and shall be identical to the proposed installation in thickness, color, texture, insulation and workmanship.

#### SD-06 Test Reports

Exterior Insulation and Finish System

Test Reports indicating that the system complies with the specified performance tests. Tests shall be by an approved, independent testing laboratory.

#### SD-08 Manufacturer's Instructions

## Exterior Insulation and Finish System

Two copies of manufacturer's standard printed instructions for installation of the system. Instructions shall include manufacturer's recommended details for corner treatment, jambs, sills, openings, joints and other special applications.

### Manufacturer's Approval and License

Statement from manufacturer attesting that the applicator is approved and licensed to install the system.

## 1.5 DELIVERY AND STORAGE

Materials shall be delivered to the jobsite in their original unopened packages, clearly marked with the manufacturer's name, brand name, and description of contents. Storage shall be in accordance with the manufacturer's recommendations in a clean, dry, well-ventilated area. Stored materials shall be protected from sunlight, and kept away from excessive heat. Coating materials which would be damaged by freezing shall be kept at a temperature not less than 4 degrees C. Insulation board shall not be exposed to flame or other ignition sources.

## PART 2 PRODUCTS

### 2.1 EXTERIOR CEMENT BOARD

Exterior cement board shall be a non-combustible exterior grade portland cement product. Board shall be 1220 by 2440 mm with a minimum 13 mm thickness. Boards shall consist of an aggregated portland cement core faced on both surfaces and wrapped on long edges with an embedded polymer-coated glass fiber mesh. Bonding surface shall have rough texture. Exterior cement board shall comply with the following requirements:

Property	Requirement	Test Method
Flexural Strength	5 MPa, Min.	ASTM C 947
Compressive Strength	8.6 MPa, Min.	ASTM D 2394
Crack Resistance	No cracking	ASTM E 72
Non-combustibility	Pass	ASTM E 136
Flame Spread/Smoke	5/0 max.	ASTM E 84
Water Absorption	15 percent max.	ASTM C 948
Fastener Pull Resistance	534 N (wet or dry)	ASTM C 473

### 2.2 ADHESIVE

Adhesive shall be the manufacturer's standard product, including primer as required, and shall be compatible with the substrate to which the system is applied.

### 2.3 INSULATION

Insulation shall conform to ASTM C 578, type as recommended by the system manufacturer and shall be compatible with other system components. Insulation shall be aged a minimum of 6 weeks by air drying, or equivalent prior to installation. Insulation shall be a standard product of the manufacturer and shall be factory marked with the manufacturer's name or trade mark, the material specification number, the R-value at 24 degrees C, and thickness. Thickness of insulation shall be based on specified R-value, but no single layer shall be less than 25 mm thick. Boards shall be marked individually. The thermal resistance of insulation in the system shall be not less than the R-value shown on the drawings. Insulation for Class PM and insulation extending below grade shall be restricted to a low water vapor permeability grade of extruded polystyrene (type IV or X).

### 2.4 BASE COAT

Base coat shall be the manufacturer's standard product and shall be compatible with the finish coat.

### 2.5 REINFORCING FABRIC

Reinforcing fabric shall be balanced, open weave, glass fiber fabric made from twisted multi-end strands specifically treated for compatibility with the other materials of the system.

### 2.6 MECHANICAL ANCHORS

Mechanical anchors shall be as recommended by the system manufacturer.

### 2.7 FINISH COATING

Finish coating shall be manufacturer's standard product, uniform in color and conforming to the following requirements. Specimens for tests shall have been cured for a minimum of 28 days.

TEST	RESULTS	METHOD
Abrasion Resistance	500 liters of sand-slight - smoothing - no loss of film integrity.	ASTM D 968
Accelerated weathering Light and water exposure	2000 hours. No deterioration	ASTM G 23 or ASTM G 53
Mildew-fungus	Expose for 28	ASTM C 1149

TEST	RESULTS	METHOD
resistance	days at 95 percent RH, 32 degrees C temperature. No growth of mildew or fungus.	
Salt spray resistance	Withstand 300 hours. No deleterious effects.	ASTM B 117
Water vapor	Not more than 13 grams per square meter an hour.	ASTM E 96
Absorption-freeze (Pre-weighed 100 mm by 200 mm specimens; 25 mm insulation, faced with finish coat cured and stored in air; tested with edges and back open).	After 50 cycles - Total weight gain of not more than 6.2 grams. No checking, splitting, or cracking	ASTM C 67 50 Cycles: 20 hrs. at -9 degrees C; 4-hr. thaw in water

## 2.8 SEALANT

Sealant shall meet requirements of ASTM C 920, Class 25, and shall be compatible with the finish system. Type, Grade, and Use shall be as recommended by both the sealant manufacturer and the system manufacturer. When required, primer, bond breaker and backstop shall be non-staining, and as recommended by the sealant manufacturer and the system manufacturer.

## 2.9 ACCESSORIES

Accessories shall conform to the recommendations of the system manufacturer and shall include trim, edging, anchors, sealant and filler rod required for proper installation of the system.

## PART 3 EXECUTION

### 3.1 SURFACE PREPARATION

Surface shall be free of oil, loose materials or protrusions which will interfere with the system installation.

### 3.2 ENVIRONMENTAL CONDITION

Unless a higher temperature is required by the system manufacturer, the ambient air temperature shall be 4 degrees C or greater and rising at the time of installation of the system and shall be predicted to remain at 4

degrees C or greater for at least 24 hours after installation.

### 3.3 EXTERIOR CEMENT BOARD

Exterior cement board shall be attached to metal studs with self-tapping wafer-head, corrosion resistant screws, nailed to wood studs, or secured to concrete or masonry with approved fasteners. Screws and nails for application of the board shall be spaced not more than 200 mm on each supporting member, and fasteners into concrete or masonry shall be spaced not more than 300 mm apart horizontally and vertically. Fasteners shall be more closely spaced when required for negative wind load resistance. Edges and ends of boards shall be butted snugly with vertical joints staggered to provide full and even support for the insulation.

### 3.4 INSULATION BOARD AND REINFORCING FABRIC

Unless otherwise specified by the system manufacturer, insulation boards shall be placed horizontally from a level base line. Vertical joints shall be staggered and insulation boards interlocked at corners. Joints of insulation shall be butted tightly. Surfaces of adjacent insulation boards shall be flush at joints. Joints of insulation shall be offset from substrate joints. Reinforcing glass fabric shall be installed in accordance with the manufacturer's instructions.

### 3.5 ADHESIVE SYSTEM

Primer (if required by the manufacturer) and adhesive shall be prepared and applied with a stainless steel trowel to substrate in accordance with the manufacturer's instructions. The pattern of the reinforcing fabric shall not be visible. Adhesive used with Class PM must be supplemented with mechanical fasteners. Adhesive shall be used without fasteners only with Class PB system and when recommended by the manufacturer.

### 3.6 BASE COAT

Base coat shall be mixed in accordance with the manufacturer's instructions and applied to insulated wall surfaces, trowelling the material into the reinforcing fabric in a tight coat and doubling back to provide complete coverage of the reinforcing fabric, panel joints and fasteners. Base coat may be used to level out surface areas when permitted by the manufacturer.

### 3.7 FINISH COATING

Finish coating shall be applied and leveled in one operation. Final texture shall be obtained by trowels, floats, or by spray application as necessary to achieve the required finish. Finish surfaces shall be plane, with no deviation greater than 6 mm when tested with a 3 m straightedge.

### 3.8 SEALANT

Edges of the exterior insulation and finish system shall be sealed at openings as recommended by the system manufacturer.

-- End of Section --





## SECTION 07416

STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM  
10/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA Design Manual (2000) Aluminum Design Manual: Specification & Guidelines for Aluminum Structures

## AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC ASD Spec S335 (1989) Specification for Structural Steel Buildings - Allowable Stress Design, Plastic Design

## AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI Cold-Formed Mn1 (1996) Cold-Formed Steel Design Manual

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 463/A 463M (1999a) Steel Sheet, Aluminum-Coated, by the Hot-Dip Process

ASTM A 653/A 653M (1999a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

ASTM A 792/A 792M (1999) Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process

ASTM B 209 (1996) Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 209M (1995) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

ASTM C 518 (1998) Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

ASTM C 991 (1998) Flexible Glass Fiber Insulation for

## Pre-Engineered Metal Buildings

ASTM C 1177/C 1177M	(1999) Glass Mat Gypsum Substrate for Use as Sheathing
ASTM C 1289	(1998) Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D 522	(1993a) Mandrel Bend Test of Attached Organic Coatings
ASTM D 523	(1989; R 1999) Specular Gloss
ASTM D 610	(1995) Evaluating Degree of Rusting on Painted Steel Surfaces
ASTM D 714	(1987; R 1994el) Evaluating Degree of Blistering of Paints
ASTM D 968	(1993) Abrasion Resistance of Organic Coatings by Falling Abrasive
ASTM D 1308	(1987; R 1998) Effect of Household Chemicals on Clear and Pigmented Organic Finishes
ASTM D 1654	(1992) Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments
ASTM D 2244	(1995) Calculation of Color Differences from Instrumentally Measured Color Coordinates
ASTM D 2247	(1999) Testing Water Resistance of Coatings in 100% Relative Humidity
ASTM D 2794	(1993; R 1999el) Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact)
ASTM D 3359	(1997) Measuring Adhesion by Tape Test
ASTM D 4214	(1998) Evaluating Degree of Chalking of Exterior Paint Films
ASTM D 4397	(1996) Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications
ASTM D 4587	(1991) Conducting Tests on Paint and Related Coatings and Materials Using a Fluorescent UV-Condensation Light- and Water-Exposure Apparatus
ASTM D 5894	(1996) Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal, (Alternating Exposures in a Fog/Dry Cabinet and a

UV/Condensation Cabinet)

ASTM E 84	(1999) Surface Burning Characteristics of Building Materials
ASTM E 96	(1995) Water Vapor Transmission of Materials
ASTM E 1592	(1998) Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference

#### AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(1998) Minimum Design Loads for Buildings and Other Structures
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#### STEEL JOIST INSTITUTE (SJI)

SJI Specs & Tables	(1994) Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders
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### 1.2 GENERAL REQUIREMENTS

The Contractor shall furnish a commercially available roofing system which satisfies all requirements contained herein and has been verified by load testing and independent design analyses to meet the specified design requirements.

#### 1.2.1 Structural Standing Seam Metal Roof (SSSMR) System

The SSSMR system covered under this specification shall include the entire roofing system; the standing seam metal roof panels, metal soffit panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with ASTM E 1592. In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as vents, curbs, exterior gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system.

#### 1.2.2 Manufacturer

The SSSMR system shall be the product of a manufacturer who has been in the practice of manufacturing and designing SSSMR systems for a period of not less than 3 years and has been involved in at least five projects similar in size and complexity to this project.

#### 1.2.3 Installer

The installer shall be certified by the SSSMR system manufacturer to have experience in installing at least three projects that are of comparable size, scope and complexity as this project for the particular roof system

furnished. The installer may be either employed by the manufacturer or be an independent installer.

### 1.3 DESIGN REQUIREMENTS

The design of the SSSMR system shall be provided by the Contractor as a complete system. Members and connections not indicated on the drawings shall be designed by the Contractor. Roof panels, components, transitions, accessories, and assemblies shall be supplied by the same roofing system manufacturer.

#### 1.3.1 Design Criteria

Design criteria shall be in accordance with ASCE 7.

#### 1.3.2 Dead Loads

The dead load shall be the weight of the SSSMR system. Collateral loads such as sprinklers, mechanical and electrical systems, and ceilings shall not be attached to the panels.

#### 1.3.3 Live Loads

##### 1.3.3.1 Concentrated Loads

The panels and anchor clips shall be capable of supporting a 1335 N concentrated load. The concentrated load shall be applied at the panel midspan and will be resisted by a single standing seam metal roof panel assumed to be acting as a beam. The undeformed shape of the panel shall be used to determine the section properties.

##### 1.3.3.2 Uniform Loads

The panels and concealed anchor clips shall be capable of supporting a minimum uniform live load of 960 Pa.

#### 1.3.4 Roof Snow Loads

The design roof snow loads shall be as shown on the contract drawings.

#### 1.3.5 Wind Loads

The design wind uplift pressure for the roof system shall be as shown on the contract drawings. The design uplift force for each connection assembly shall be that pressure given for the area under consideration, multiplied by the tributary load area of the connection assembly. The safety factor listed below shall be applied to the design force and compared against the ultimate capacity. Prying shall be considered when figuring fastener design loads.

- a. Single fastener in each connection.....3.0
- b. Two or more fasteners in each connection...2.25

#### 1.3.6 Thermal Loads

Roof panels shall be free to move in response to the expansion and contraction forces resulting from a total temperature range of 104 degrees C during the life of the structure.

#### 1.3.7 Framing Members Supporting the SSSMR System

Any additions/revisions to framing members supporting the SSSMR system to accommodate the manufacturer/fabricator's design shall be the Contractor's responsibility and shall be submitted for review and approval. New or revised framing members and their connections shall be designed in accordance with AISI Cold-Formed Mnl. Maximum deflection under applied live load, snow, or wind load shall not exceed 1/180 of the span length.

#### 1.3.8 Roof Panels Design

Steel panels shall be designed in accordance with AISI Cold-Formed Mnl. Aluminum panels shall be designed in accordance with AA Design Manual. The structural section properties used in the design of the panels shall be determined using the unloaded shape of the roof panels. The calculated panel deflection from concentrated loads shall not exceed 1/180 of the span length. The calculated panel deflection under applied live load, snow, or wind load shall not exceed 1/180 times the span length. Deflections shall be based on panels being continuous across three or more supports, fastener spacing, and the ability of the panel to rotate freely on the support. Deflection shall be calculated and measured along the major ribs of the panels.

#### 1.3.9 Accessories and Their Fasteners

Accessories and their fasteners shall be capable of resisting the specified design wind uplift forces and shall allow for thermal movement of the roof panel system. Exposed fasteners shall not restrict free movement of the roof panel system resulting from thermal forces. There shall be a minimum of two fasteners per clip. Single fasteners with a minimum diameter of 9 mm will be allowed when the supporting structural members are prepunched or predrilled.

### 1.4 PERFORMANCE REQUIREMENTS

The SSSMR shall be tested for wind uplift resistance in accordance with ASTM E 1592; SSSMR systems previously tested and approved by the Corps of Engineers' STANDARD TEST METHOD FOR STRUCTURAL PERFORMANCE OF SSMRS BY UNIFORM STATIC AIR PRESSURE DIFFERENCE may be acceptable. Two tests shall be performed. Test 1 shall simulate the edge condition with one end having crosswise restraint and other end free of crosswise restraint. The maximum span length for the edge condition shall be 750 mm. Test 2 shall simulate the interior condition with both ends free of crosswise restraint. The maximum span length for the interior condition shall be 1.5 m. External reinforcement, such as clamps on the ribs, shall not be installed to improve uplift resistance. Bolts through seams shall not be installed.

### 1.5 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-02 Shop Drawings

Structural Standing Seam Metal Roof System; GA-BK, GA-CH, GA-DN, GA-HQ

Metal roofing drawings and specifications and erection drawings; shop coating and finishing specifications; and other data as necessary to clearly describe design, materials, sizes, layouts, standing seam configuration, construction details, provisions for thermal movement, line of panel fixity, fastener sizes and spacings, sealants and erection procedures. Drawings shall reflect the intent of the architectural detailing using the manufacturer's proprietary products and fabricated items as required. The SSSMR system shop drawings shall be provided by the metal roofing manufacturer. The shop drawings shall also include the SSSMR component details that resulted from the design calculations and the wind uplift testing required herein. The shop drawings also shall show the locations and configuration of any thermal spacer blocks or barriers. Subpurlin layouts shall be shown and the spacing must be coordinated with the metal deck configuration, lap locations, and sidelap configurations.

#### SD-03 Product Data

Design Analysis; GA-BK, GA-CH, GA-DN, GA-HQ

Design analysis signed by a Registered Professional Engineer, and submitted for approval prior to beginning of manufacturer. The design analysis shall include, but not be limited to the following information.

A list of the design loads.

Thermal movements that will result from the specified temperature range. The calculations shall be accompanied by details from the manufacturer that demonstrate how installed concealed anchor clips and other roof system devices will accommodate the required thermal movement.

Concentrated load and roof live load analysis.

Subpurlin catalog cuts, section property information and sketches to indicate that the subpurlins geometry has been coordinated with the metal deck configuration and that the subpurlins will nest properly in the metal deck flutes.

Complete calculations of the support system including purlins and/or subpurlins designed in accordance with subparagraph: Framing members.

Wind forces on various parts of the roof. Both positive and negative pressures shall be calculated based on the criteria in subparagraph: Design Conditions and parameters in subparagraph: Wind Uplift Loads. The resultant wind uplift forces and dimensions of the edge and corner zones will be shown on an isometric view of the roof.

#### SD-04 Samples

Accessories; GA-BK, GA-CH, GA-DN, GA-HQ

One sample of each type of flashing, trim, closure, thermal spacer block, cap and similar items. Size shall be sufficient to show construction and configuration.

Roof Panels; GA-BK, GA-CH, GA-DN, GA-HQ

One piece of each type to be used, 225 mm long, full width.

Factory Color Finish; GA-BK, GA-CH, GA-DN, GA-HQ

Three 75 by 125 mm samples of each type and color.

Fasteners; GA-BK, GA-CH, GA-DN, GA-HQ

Two samples of each type to be used, with statement regarding intended use. If so requested, random samples of bolts, nuts, and washers as delivered to the job site shall be taken in the presence of the Contracting Officer and provided to the Contracting Officer for testing to establish compliance with specified requirements.

Insulation; GA-BK, GA-CH, GA-DN, GA-HQ

One piece, 300 by 300 mm, of each type and thickness to be used, with a label indicating the rated permeance (if faced) and R-values. The flame spread, and smoke developed rating shall be shown on the label or provided in a letter of certification.

Gaskets and Insulating Compounds; GA-BK, GA-CH, GA-DN, GA-HQ

Two samples of each type to be used and descriptive data.

Sealant; GA-BK, GA-CH, GA-DN, GA-HQ

One sample, approximately 0.5 kg, and descriptive data.



Concealed Anchor Clips; GA-BK, GA-CH, GA-DN, GA-HQ

Two samples of each type used.

Subpurlins; GA-BK, GA-CH, GA-DN, GA-HQ

One piece, 225 mm long.

EPDM Rubber Boots; GA-BK, GA-CH, GA-DN, GA-HQ

One piece of each type.

External attachments; GA-BK, GA-CH, GA-DN, GA-HQ

Two samples of every type of permanent external attachment either, clips or clamps, used in the tested system to increase the rated capacity of the roofing system.

#### SD-06 Test Reports

Test Report for Uplift Resistance of the SSSMR; GA-BK, GA-DN, GA-CH, GA-HQ

The report shall include the following information:

Details of the SSSMR system showing the roof panel cross-section with dimensions and thickness.

Details of the anchor clip, dimensions, and thickness.

Type of fasteners, size, and the number required for each connection.

Purlins/subpurlins size and spacing used in the test.

Description of the seaming operation including equipment used.

Maximum allowable uplift pressures. These pressures are determined from the ultimate load divided by a factor of safety equal to 1.65.

Any additional information required to identify the SSSMR system tested.

Signature and seal of an independent registered engineer who witnessed the test.

Fastener Test Report (Additional Requirement)- Manufacturer's test report or independent test laboratory report. Tests shall be performed on fasteners and supporting members that are made from the same materials and are equal or less in size and thickness to the fasteners and supporting members used in the actual roof installation.

Panel Finish Color (Additional Requirement)- Test results shall be

submitted for all roofing panels showing the results of testing in accordance with the color finish tests specified in paragraphs 2.6.1 through 2.6.8.

#### SD-07 Certificates

##### Structural Standing Seam Metal Roof System

Certification that the actual thickness of uncoated sheets used in SSSMRS components including roofing panels, subpurlins, and concealed anchor clips complies with specified requirements.

Certification that materials used in the installation are mill certified.

Previous certification of SSSMR system tested under the Corps of Engineers' Standard Test Method in lieu of ASTM E 1592 testing.

Certification that the sheets to be furnished are produced under a continuing quality control program and that a representative sample consisting of not less than three pieces has been tested and has met the quality standards specified for factory color finish.

Certification of installer. Installer certification shall be furnished.

Warranty certificate. At the completion of the project the Contractor shall furnish signed copies of the 5-year Warranty for Structural Standing Seam Metal Roof (SSSMR) System, a sample copy of which is attached to this section, and the 20-year Manufacturer's Material Warranties, and the manufacturer's 20-year system weathertightness warranty.

##### Insulation

Certificate attesting that the polyurethane or polyisocyanurate insulation furnished for the project contains recovered material, and showing an estimated percent of such recovered material.

#### SD-08 Manufacturer's Instructions

##### Qualifications

Qualifications of the manufacturer and installer.

Qualifications of the manufacturer and installer.

#### 1.6 DELIVERY AND STORAGE

Materials shall be delivered to the site in a dry and undamaged condition and stored out of contact with the ground. Materials shall be covered with weathertight coverings and kept dry. Storage conditions shall provide good air circulation and protection from surface staining.

## 1.7 WARRANTIES

The SSSMR system shall be warranted as outlined below. Any emergency temporary repairs conducted by the owner shall not negate the warranties.

### 1.7.1 Contractor's Weathertightness Warranty

The SSSMR system shall be warranted by the Contractor on a no penal sum basis for a period of five years against material and workmanship deficiencies; system deterioration caused by exposure to the elements and/or inadequate resistance to specified service design loads, water leaks, and wind uplift damage. The SSSMR system covered under this warranty shall include the entire roofing system including, but not limited to, the standing seam metal roof panels, fasteners, connectors, roof securement components, and assemblies tested and approved in accordance with ASTM E 1592.

In addition, the system shall consist of panel finishes, slip sheet, insulation, vapor retarder, all accessories, components, and trim and all connections with roof panels. This includes roof penetration items such as vents, curbs, and skylights; exterior gutters and downspouts; eaves, ridge, hip, valley, rake, gable, wall, or other roof system flashings installed and any other components specified within this contract to provide a weathertight roof system; and items specified in other sections of these specifications that are part of the SSSMR system. All material and workmanship deficiencies, system deterioration caused by exposure to the elements and/or inadequate resistance to specified design loads, water leaks and wind uplift damage shall be repaired as approved by the Contracting Officer. See the attached Contractor's required warranty for issue resolution of warrantable defects. This warranty shall warrant and cover the entire cost of repair or replacement, including all material, labor, and related markups. The Contractor shall supplement this warranty with written warranties from the installer and system manufacturer, which shall be submitted along with Contractor's warranty; however, the Contractor shall be ultimately responsible for this warranty. The Contractor's written warranty shall be as outlined in attached WARRANTY FOR STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM, and shall start upon final acceptance of the facility. It is required that the Contractor provide a separate bond in an amount equal to the installed total roofing system cost in favor of the owner (Government) covering the Contractor's warranty responsibilities effective throughout the five year Contractor's warranty period for the entire SSSMR system as outlined above.

### 1.7.2 Manufacturer's Material Warranties.

The Contractor shall furnish, in writing, the following manufacturer's material warranties which cover all SSSMR system components such as roof panels, anchor clips and fasteners, flashing, accessories, and trim, fabricated from coil material:

- a. A manufacturer's 20 year material warranty warranting that the zinc-coated steel, as specified herein will not rupture, structurally fail, fracture, deteriorate, or become perforated under normal design atmospheric conditions and service design loads. Liability under this warranty shall be limited exclusively to the cost of either repairing or replacing nonconforming, ruptured,

- perforated, or structurally failed coil material.
- b. A manufacturer's 20 year exterior material finish warranty on the factory colored finish warranting that the finish, under normal atmospheric conditions at the site, will not crack, peel, or delaminate; chalk in excess of a numerical rating of eight, as determined by ASTM D 4214 test procedures; or change color in excess of five CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244. Liability under this warranty is exclusively limited to refinishing with an air-drying version of the specified finish or replacing the defective coated material.
  - c. A roofing system manufacturer's 20 year system weathertightness warranty.

## 1.8 COORDINATION MEETING

A coordination meeting shall be held 30 days prior to the first submittal, for mutual understanding of the Structural Standing Seam Metal Roof (SSSMR) System contract requirements. This meeting shall take place at the building site and shall include representatives from the Contractor, the roof system manufacturer, the roofing supplier, the erector, the SSSMR design engineer of record, and the Contracting Officer. All items required by paragraph SUBMITTALS shall be discussed, including applicable standard manufacturer shop drawings, and the approval process. The Contractor shall coordinate time and arrangements for the meeting.

## PART 2 PRODUCTS

### 2.1 ROOF PANELS

Panels shall be steel or aluminum and shall have a factory color mill finish. Length of sheets shall be sufficient to cover the entire length of any unbroken roof slope for slope lengths that do not exceed 9 m. When length of run exceeds 9 m and panel laps are provided, each sheet in the run shall extend over three or more supports. Sheets longer than 30 m may be furnished if approved by the Contracting Officer. Width of sheets shall provide not more than 600 mm of coverage in place. SSSMR system with roofing panels greater than 300 mm in width shall have standing seams rolled during installation by an electrically driven seaming machine. Height of standing seams shall be not less than 50 mm.

#### 2.1.1 Steel Panels

Steel panels shall be zinc-coated steel conforming to ASTM A 653/A 653M. Zinc, zinc-aluminum alloy or aluminum coated panels shall be 0.61 mm thick minimum, except that areas of the roof subject to design wind uplift pressures of 2.87 kPa (60 psf) or greater shall have a minimum panel thickness of 0.76 mm (0.030 inch). Panels shall be within 95 percent of reported tested thickness as noted in wind uplift resistance testing required in paragraph PERFORMANCE REQUIREMENTS.

### 2.2 CONCEALED ANCHOR CLIPS

Concealed anchor clips shall be the same as the tested roofing system. Clip bases shall have factory punched or drilled holes for attachment. Clips shall be made from multiple pieces with the allowance for the total thermal movement required to take place within the clip. Single piece clips may be acceptable when the manufacturer can substantiate that the system can accommodate the thermal cyclic movement under sustained live or snow loads.

## 2.3 ACCESSORIES

Flashing, trim, metal closure strips, caps and similar metal accessories shall be the manufacturer's standard products. Exposed metal accessories shall be finished to match the panels furnished. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or polyvinyl chloride premolded to match configuration of the panels and shall not absorb or retain water. The use of a continuous angle butted to the panel ends to form a closure will not be allowed. Thermal spacer blocks and other thermal barriers shall be submitted for approval.

## 2.4 FASTENERS

Fasteners for steel roof panels shall be zinc-coated steel, type and size specified below or as otherwise approved for the applicable requirements. Fasteners for structural connections shall provide both tensile and shear ultimate strengths of not less than 3340 N per fastener. Fasteners for accessories shall be the manufacturer's standard. Exposed roof fasteners shall be sealed or have sealed washers on the exterior side of the roof to waterproof the fastener penetration. Washer material shall be compatible with the roofing; have a minimum diameter of 10 mm for structural connections; and gasketed portion of fasteners or washers shall be neoprene or other equally durable elastomeric material approximately 3 mm thick. Exposed fasteners for factory color finished panels shall be factory finished to match the color of the panels.

### 2.4.1 Screws

Screws for attaching anchor devices shall be not less than No. 14 self-tapping type and not less than No. 12 if self-drilling and self-tapping type. Actual screw pull out test results shall be performed for the actual material gage and yield strength of the structural purlins or subpurlins to which the clip is to be anchored/attached. Other screws shall be as recommended by the manufacturer to meet the strength design requirements of the panels.

### 2.4.2 Bolts

Bolts shall be not less than 6 mm diameter, shouldered or plain shank as required, with locking washers and nuts.

### 2.4.3 Structural Blind Fasteners

Blind screw-type expandable fasteners shall be not less than 6 mm diameter. Blind (pop) rivets shall be not less than 7 mm minimum diameter.

## 2.5 SUBPURLINS

Cold formed supporting structural members/subpurlins shall have a minimum thickness of 1.5 mm and a minimum tensile yield strength of 345 MPa. Hot rolled structural members shall have a minimum thickness of 6 mm and a minimum tensile yield strength of 248 MPa. Subpurlins shall be shop painted.

## 2.6 FACTORY COLOR FINISH

Panels shall have a factory applied polyvinylidene fluoride finish on the exposed side. The exterior finish shall consist of a baked-on topcoat with an appropriate prime coat. Color shall match the color indicated on the drawings. The exterior coating shall be a nominal 0.025 mm thickness consisting of a topcoat of not less than 0.018 mm dry film thickness and the paint manufacturer's recommended primer of not less than 0.005 mm thickness.

The interior color finish shall consist of the same coating and dry film thickness as the exterior a backer coat with a dry film thickness of 0.013 mm.

The exterior color finish shall meet the test requirements specified below.

### 2.6.1 Salt Spray Test

A sample of the sheets shall withstand a cyclic corrosion test for a minimum of 2016 hours in accordance with ASTM D 5894, including the scribe requirement in the test. Immediately upon removal of the panel from the test, the coating shall receive a rating of not less than 10, no blistering, as determined by ASTM D 714; 10, no rusting, as determined by ASTM D 610; and a rating of 6, over 2.0 to 3.0 mm failure at scribe, as determined by ASTM D 1654.

### 2.6.2 Formability Test

When subjected to testing in accordance with ASTM D 522 Method B, 3 mm diameter mandrel, the coating film shall show no evidence of cracking to the naked eye.

### 2.6.3 Accelerated Weathering, Chalking Resistance and Color Change

A sample of the sheets shall be tested in accordance with ASTM D 4587, test condition B for 500 total hours. The coating shall withstand the weathering test without cracking, peeling, blistering, loss of adhesion of the protective coating, or corrosion of the base metal. Protective coating that can be readily removed from the base metal with tape in accordance with ASTM D 3359, Test Method B, shall be considered as an area indicating loss of adhesion. Following the accelerated weathering test, the coating shall have a chalk rating not less than No. 8 in accordance with ASTM D 4214 test procedures, and the color change shall not exceed 5 CIE or Hunter Lab color difference (delta E) units in accordance with ASTM D 2244.

### 2.6.4 Humidity Test

When subjected to a humidity cabinet test in accordance with ASTM D 2247 for 1000 hours, a scored panel shall show no signs of blistering, cracking, creepage or corrosion.

#### 2.6.5 Impact Resistance

Factory-painted sheet shall withstand direct and reverse impact in accordance with ASTM D 2794 13 mm diameter hemispherical head indenter, equal to 6.7 times the metal thickness in mm, expressed in Newton-meters, with no cracking.

#### 2.6.6 Abrasion Resistance Test

When subjected to the falling sand test in accordance with ASTM D 968, Method A, the coating system shall withstand a minimum of 50 liters of sand before the appearance of the base metal. The term "appearance of base metal" refers to the metallic coating on steel or the aluminum base metal.

#### 2.6.7 Pollution Resistance

Coating shall show no visual effects when covered spot tested in a 10 percent hydrochloric acid solution for 24 hours in accordance with ASTM D 1308.

### 2.7 INSULATION

Thermal resistance of insulation shall be not less than the R-values shown on the contract drawings. R-values shall be determined at a mean temperature of 24 degrees C in accordance with ASTM C 518. Insulation shall be a standard product with the insulation manufacturer, factory marked or identified with insulation manufacturer's name or trademark and R-value. Identification shall be on individual pieces or individual packages. Insulation, including facings, shall have a flame spread not in excess of 25 and a smoke developed rating not in excess of 50 when tested in accordance with ASTM E 84. The stated R-value of the insulation shall be certified by an independent Registered Professional Engineer if tests are conducted in the insulation manufacturer's laboratory.

#### 2.7.1 Polyisocyanurate Rigid Board Insulation for Use Above a Roof Deck

Polyisocyanurate insulation shall conform to ASTM C 1289, Type II, (having a minimum recovered material content of 9 percent by weight of core material in the polyisocyanurate portion). For 25 mm polyisocyanurate, the maximum design R-value used shall be 6.0. Facings shall be non-asphaltic, glass fiber reinforced.

#### 2.7.2 Blanket Insulation

Blanket insulation shall conform to ASTM C 991.

### 2.8 INSULATION RETAINERS

Insulation retainers shall be type, size, and design necessary to adequately hold the insulation and to provide a neat appearance. Metallic retaining members shall be nonferrous or have a nonferrous coating. Nonmetallic retaining members, including adhesives used in conjunction with mechanical retainers or at insulation seams, shall have a fire resistance classification not less than that permitted for the insulation.

## 2.9 SEALANT

Sealants shall be elastomeric type containing no oil or asphalt. Exposed sealant shall be colored to match the applicable building color clear and shall cure to a rubberlike consistency. Sealant placed in the roof panel standing seam ribs shall be provided in accordance with the manufacturer's recommendations.

## 2.10 GASKETS AND INSULATING COMPOUNDS

Gaskets and insulating compounds shall be nonabsorptive and suitable for insulating contact points of incompatible materials. Insulating compounds shall be non-running after drying.

## 2.11 VAPOR RETARDER

### 2.11.1 Vapor Retarders Separate from Insulation

Vapor retarder material shall be polyethylene sheeting conforming to ASTM D 4397. A single ply of 0.25 mm polyethylene sheet; or, at the Contractor's option, a double ply of 0.15 mm polyethylene sheet shall be used. A fully compatible polyethylene tape which has equal or better water vapor control characteristics than the vapor retarder material shall be provided. A cloth industrial duct tape in a utility grade shall also be provided to use as needed to protect the vapor retarder from puncturing.

### 2.11.2 Slip Sheet for Use With Vapor Retarder

Slip sheet for use with vapor retarder shall be a 0.24 kg per square meter rosin-sized, unsaturated building paper.

## 2.12 EPDM RUBBER BOOTS

Flashing devices around pipe penetrations shall be flexible, one-piece devices molded from weather-resistant EPDM rubber. Rubber boot material shall be as recommended by the manufacturer. The boots shall have base rings made of aluminum or corrosion resisting steel that conform to the contours of the roof panel to form a weather-tight seal.

## 2.13 SNOW PROTECTION SYSTEM

Provide a snow protection system at the downward slope of all metal roofing, 200 mm to 300 mm from the eave edge. Snow protection system shall be LM Curbs "S-5 Colorgard" or equal. Snow protection system shall consist of 2 clamps per panel, fastened with stainless steel bolt and washer furnished by the manufacturer. The ColorGard shall be furnished and installed on each S-5 clamp and is prepunched on 100 mm centers. Furnish and install a 52 mm wide x 2400 mm long color strip into each ColorGard system with a color that matches the metal roof. Follow manufacturers instructions for installation.

## 2.14 SOFFIT AND CEILING PANELS

Soffit and ceiling panels shall be 0.6 mm thick minimum for aluminium or



0.45 mm thick minimum for steel with the same composition specified for structural standing seam metal roof panels, shall have a flush face without perforations, shall be capable of spanning the distances between the ceiling framing system without sagging, waviness and distortion, shall provide for expansion of the metal material, and shall be located as shown on the drawings. matching metal trim shall be provided at all edges of panels, including openings in the ceiling system. Soffit and ceiling panels shall have the same finish as specified for the insulated metal wall panels and shall be the color as indicated on the exterior finish schedule on the drawings. Ceiling hatches shall be provided at locations shown on the drawings for access to mechanical equipment. Soffit and ceiling panels shall be installed without visible fasteners.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's erection instructions and drawings. Dissimilar materials which are not compatible when contacting each other shall be insulated by means of gaskets or insulating compounds. Molded closure strips shall be installed wherever roofing sheets terminate in open-end configurations, exclusive of flashings.

The closure strip installation shall be weather-tight and sealed. Screws shall be installed with a clutching screw gun, to assure screws are not stripped. Field test shall be conducted on each gun prior to starting installation and periodically thereafter to assure it is adjusted properly to install particular type and size of screw as recommended by manufacturer's literature. Improper or mislocated drill holes shall be plugged with an oversize screw fastener and gasketed washer; however, sheets with an excess of such holes or with such holes in critical locations shall not be used. Exposed surfaces and edges shall be kept clean and free from sealant, metal cuttings, hazardous burrs, and other foreign material. Stained, discolored, or damaged sheets shall be removed from the site.

##### 3.1.1 Field Forming of Panels for Unique Area

When roofing panels are formed from factory-color-finished steel coils at the project site, the same care and quality control measures that are taken in shop forming of roofing panels shall be observed. Rollformer shall be operated by the metal roofing manufacturer's representative. In cold weather conditions, preheating of the steel coils to be field formed shall be performed as necessary just prior to the rolling operations.

##### 3.1.2 Subpurlins

Unless otherwise shown, subpurlins shall be anchored to the purlins or other structural framing members with bolts or screws. Attachment to the substrate (when provided) or to the panels is not permitted. The subpurlin spacing shall not exceed 750 mm on centers at the corner, edge and ridge zones, and 1500 mm maximum on centers for the remainder of the roof. Corner, edge, and ridge zones are as defined in ASCE 7. Closer spacing may be required by the roofing manufacturer to meet the roof uplift loads shown on the contract documents.

### 3.1.3 Roof Panel Installation

Roof panels shall be installed with the standing seams in the direction of the roof slope. The side seam connections for installed panels shall be completed at the end of each day's work. Method of applying joint sealant shall conform to the manufacturer's recommendation to achieve a complete weather-tight installation. End laps of panels shall be provided in accordance with the manufacturer's instructions. Closures, flashings, EPDM rubber boots, roof curbs, and related accessories shall be installed according to the manufacturer's drawings. Fasteners shall not puncture roofing sheets except as provided for in the manufacturer's instructions for erection and installation. Expansion joints for the standing seam roof system shall be installed at locations indicated on the contract drawings and other locations indicated on the manufacturer's drawings.

### 3.1.4 Concealed Anchor Clips

Roof panels shall be fastened to framing members with concealed fastening clips or other concealed devices. Clips shall be attached directly to the building structural system or to the subpurlins with bolts or screws. Attachment to the substrate (when provided) or to the metal deck is not permitted. The maximum distance, parallel to the seams, between clips shall be 750 mm on center at the corner, edge, and ridge zones, and 1500 mm maximum on centers for the remainder of the roof. Closer spacing may be required by the roofing manufacturer to meet the roof uplift pressures shown on top contract documents. Attachment of clips through rigid insulation to structure is prohibited.

## 3.2 INSULATION INSTALLATION

Insulation shall be continuous over entire roof surface. Where expansion joints, terminations, and other connections are made, the cavity shall be filled with batt insulation with vapor retarder providing equivalent R-value and perm rating as remaining insulation. Insulation shall be installed as indicated and in accordance with manufacturer's instructions.

### 3.2.1 Board Insulation with Blanket Insulation

Rigid or semirigid board insulation shall be laid in close contact. Board shall be attached to the metal roof deck with bearing plates and fasteners, as recommended by the insulation manufacturer, so that the insulation joints are held tight against each other, and shall have a minimum of 1 fastener per 0.37 square meters. Layout and joint pattern of insulation and fasteners shall be indicated on the shop drawings. If more than one layer of insulation is required, joints in the second layer shall be offset from joints in the first layer. A layer of blanket insulation shall be placed over the rigid or semirigid board insulation to be compressed against the underside of the metal roofing to reduce thermal bridging, dampen noise, and prevent roofing flutter. This layer of blanket insulation shall be compressed a minimum of 50 percent. Thermal blocks shall not be placed in between the concealed anchor clips and the subpurlins or supporting structure.

## 3.3 PROTECTION OF VAPOR RETARDER FROM ROOF DECK

A cloth industrial duct tape shall be applied over the seams of metal roof decks, at penetration edges, and at surface areas exhibiting sharp burrs or similar protrusions. For other types of roof decks, cloth industrial duct tape shall be applied over irregularities which could potentially puncture polyethylene membrane.

#### 3.4 VAPOR RETARDER INSTALLATION

#### 3.5 SLIP SHEET INSTALLATION

A slip sheet shall be laid over the blanket insulation facing to prevent the vinyl facing from adhering to the metal roofing.

#### 3.6 CLEANING AND TOUCH-UP

Exposed SSSMR systems shall be cleaned at completion of installation. Debris that could cause discoloration and harm to the panels, flashings, closures and other accessories shall be removed. Grease and oil films, excess sealants, and handling marks shall be removed and the work shall be scrubbed clean. Exposed metal surfaces shall be free of dents, creases, waves, scratch marks, and solder or weld marks. Immediately upon detection, abraded or corroded spots on shop-painted surfaces shall be wire brushed and touched up with the same material used for the shop coat. Factory color finished surfaces shall be touched up with the manufacturer's recommended touch up paint.

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY  
FOR  
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM

FACILITY DESCRIPTION\_\_\_\_\_

BUILDING NUMBER:\_\_\_\_\_

CORPS OF ENGINEERS CONTRACT NUMBER:\_\_\_\_\_

CONTRACTOR

CONTRACTOR:\_\_\_\_\_

ADDRESS:\_\_\_\_\_

POINT OF CONTACT:\_\_\_\_\_

TELEPHONE NUMBER:\_\_\_\_\_

OWNER

OWNER:\_\_\_\_\_

ADDRESS:\_\_\_\_\_

POINT OF CONTACT:\_\_\_\_\_

TELEPHONE NUMBER:\_\_\_\_\_

CONSTRUCTION AGENT

CONSTRUCTION AGENT:\_\_\_\_\_

ADDRESS:\_\_\_\_\_

POINT OF CONTACT:\_\_\_\_\_

TELEPHONE NUMBER:\_\_\_\_\_

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY  
FOR  
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM  
(continued)

THE SSSMR SYSTEM INSTALLED ON THE ABOVE NAMED BUILDING IS WARRANTED BY \_\_\_\_\_ FOR A PERIOD OF FIVE (5) YEARS AGAINST WORKMANSHIP AND MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE. THE SSSMR SYSTEM COVERED UNDER THIS WARRANTY SHALL INCLUDE, BUT SHALL NOT BE LIMITED TO, THE FOLLOWING: THE ENTIRE ROOFING SYSTEM, MANUFACTURER SUPPLIED FRAMING AND STRUCTURAL MEMBERS, METAL ROOF PANELS, FASTENERS, CONNECTORS, ROOF SECUREMENT COMPONENTS, AND ASSEMBLIES TESTED AND APPROVED IN ACCORDANCE WITH ASTM E 1592. IN ADDITION, THE SYSTEM PANEL FINISHES, SLIP SHEET, INSULATION, VAPOR RETARDER, ALL ACCESSORIES, COMPONENTS, AND TRIM AND ALL CONNECTIONS ARE INCLUDED. THIS INCLUDES ROOF PENETRATION ITEMS SUCH AS VENTS, CURBS, SKYLIGHTS; INTERIOR OR EXTERIOR GUTTERS AND DOWNSPOUTS; EAVES, RIDGE, HIP, VALLEY, RAKE, GABLE, WALL, OR OTHER ROOF SYSTEM FLASHINGS INSTALLED AND ANY OTHER COMPONENTS SPECIFIED WITHIN THIS CONTRACT TO PROVIDE A WEATHERTIGHT ROOF SYSTEM; AND ITEMS SPECIFIED IN OTHER SECTIONS OF THE SPECIFICATIONS THAT ARE PART OF THE SSSMR SYSTEM.

ALL MATERIAL DEFICIENCIES, WIND DAMAGE, STRUCTURAL FAILURE, AND LEAKAGE ASSOCIATED WITH THE SSSMR SYSTEM COVERED UNDER THIS WARRANTY SHALL BE REPAIRED AS APPROVED BY THE CONTRACTING OFFICER. THIS WARRANTY SHALL COVER THE ENTIRE COST OF REPAIR OR REPLACEMENT, INCLUDING ALL MATERIAL, LABOR, AND RELATED MARKUPS. THE ABOVE REFERENCED WARRANTY COMMENCED ON THE DATE OF FINAL ACCEPTANCE ON \_\_\_\_\_ AND WILL REMAIN IN EFFECT FOR STATED DURATION FROM THIS DATE.

SIGNED, DATED, AND NOTARIZED (BY COMPANY PRESIDENT)

\_\_\_\_\_  
(Company President)

\_\_\_\_\_  
(Date)

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY  
FOR  
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM  
(continued)

THE CONTRACTOR SHALL SUPPLEMENT THIS WARRANTY WITH WRITTEN WARRANTIES FROM THE MANUFACTURER AND/OR INSTALLER OF THE SSSMR SYSTEM, WHICH SHALL BE SUBMITTED ALONG WITH THE CONTRACTOR'S WARRANTY. HOWEVER, THE CONTRACTOR WILL BE ULTIMATELY RESPONSIBLE FOR THIS WARRANTY AS OUTLINED IN THE SPECIFICATIONS AND AS INDICATED IN THIS WARRANTY EXAMPLE.

EXCLUSIONS FROM COVERAGE

1. NATURAL DISASTERS, ACTS OF GOD (LIGHTNING, FIRE, EXPLOSIONS, SUSTAINED WIND FORCES IN EXCESS OF THE DESIGN CRITERIA, EARTHQUAKES, AND HAIL).
2. ACTS OF NEGLIGENCE OR ABUSE OR MISUSE BY GOVERNMENT OR OTHER PERSONNEL, INCLUDING ACCIDENTS, VANDALISM, CIVIL DISOBEDIENCE, WAR, OR DAMAGE CAUSED BY FALLING OBJECTS.
3. DAMAGE BY STRUCTURAL FAILURE, SETTLEMENT, MOVEMENT, DISTORTION, WARPAGE, OR DISPLACEMENT OF THE BUILDING STRUCTURE OR ALTERATIONS MADE TO THE BUILDING.
4. CORROSION CAUSED BY EXPOSURE TO CORROSIVE CHEMICALS, ASH OR FUMES GENERATED OR RELEASED INSIDE OR OUTSIDE THE BUILDING FROM CHEMICAL PLANTS, FOUNDRIES, PLATING WORKS, KILNS, FERTILIZER FACTORIES, PAPER PLANTS, AND THE LIKE.
5. FAILURE OF ANY PART OF THE SSSMR SYSTEM DUE TO ACTIONS BY THE OWNER TO INHIBIT FREE DRAINAGE OF WATER FROM THE ROOF AND GUTTERS AND DOWNSPOUTS OR ALLOW PONDING WATER TO COLLECT ON THE ROOF SURFACE. CONTRACTOR'S DESIGN SHALL INSURE FREE DRAINAGE FROM THE ROOF AND NOT ALLOW PONDING WATER.
6. THIS WARRANTY APPLIES TO THE SSSMR SYSTEM. IT DOES NOT INCLUDE ANY CONSEQUENTIAL DAMAGE TO THE BUILDING INTERIOR OR CONTENTS WHICH IS COVERED BY THE WARRANTY OF CONSTRUCTION CLAUSE INCLUDED IN THIS CONTRACT.
7. THIS WARRANTY CANNOT BE TRANSFERRED TO ANOTHER OWNER WITHOUT WRITTEN CONSENT OF THE CONTRACTOR; AND THIS WARRANTY AND THE CONTRACT PROVISIONS WILL TAKE PRECEDENCE OVER ANY CONFLICTS WITH STATE STATUTES.

\* \*

CONTRACTOR'S FIVE (5) YEAR NO PENAL SUM WARRANTY  
FOR  
STRUCTURAL STANDING SEAM METAL ROOF (SSSMR) SYSTEM  
(continued)

\*\*REPORTS OF LEAKS AND SSSMR SYSTEM DEFICIENCIES SHALL BE RESPONDED TO WITHIN 48 HOURS OF RECEIPT OF NOTICE, BY TELEPHONE OR IN WRITING, FROM EITHER THE OWNER OR CONTRACTING OFFICER. EMERGENCY REPAIRS TO PREVENT FURTHER ROOF LEAKS SHALL BE INITIATED IMMEDIATELY; A WRITTEN PLAN SHALL BE SUBMITTED FOR APPROVAL TO REPAIR OR REPLACE THIS SSSMR SYSTEM WITHIN SEVEN (7) CALENDAR DAYS. ACTUAL WORK FOR PERMANENT REPAIRS OR REPLACEMENT SHALL BE STARTED WITHIN 30 DAYS AFTER RECEIPT OF NOTICE, AND COMPLETED WITHIN A REASONABLE TIME FRAME. IF THE CONTRACTOR FAILS TO ADEQUATELY RESPOND TO THE WARRANTY PROVISIONS, AS STATED IN THE CONTRACT AND AS CONTAINED HEREIN, THE CONTRACTING OFFICER MAY HAVE THE SSSMR SYSTEM REPAIRED OR REPLACED BY OTHERS AND CHARGE THE COST TO THE CONTRACTOR.

IN THE EVENT THE CONTRACTOR DISPUTES THE EXISTENCE OF A WARRANTABLE DEFECT, THE CONTRACTOR MAY CHALLENGE THE OWNER'S DEMAND FOR REPAIRS AND/OR REPLACEMENT DIRECTED BY THE OWNER OR CONTRACTING OFFICER EITHER BY REQUESTING A CONTRACTING OFFICER'S DECISION UNDER THE CONTRACT DISPUTES ACT, OR BY REQUESTING THAT AN ARBITRATOR RESOLVE THE ISSUE. THE REQUEST FOR AN ARBITRATOR MUST BE MADE WITHIN 48 HOURS OF BEING NOTIFIED OF THE DISPUTED DEFECTS. UPON BEING INVOKED, THE PARTIES SHALL, WITHIN TEN (10) DAYS, JOINTLY REQUEST A LIST OF FIVE (5) ARBITRATORS FROM THE FEDERAL MEDIATION AND CONCILIATION SERVICE. THE PARTIES SHALL CONFER WITHIN TEN (10) DAYS AFTER RECEIPT OF THE LIST TO SEEK AGREEMENT ON AN ARBITRATOR. IF THE PARTIES CANNOT AGREE ON AN ARBITRATOR, THE CONTRACTING OFFICER AND THE PRESIDENT OF THE CONTRACTOR'S COMPANY WILL STRIKE ONE (1) NAME FROM THE LIST ALTERNATIVELY UNTIL ONE (1) NAME REMAINS. THE REMAINING PERSON SHALL BE THE DULY SELECTED ARBITRATOR. THE COSTS OF THE ARBITRATION, INCLUDING THE ARBITRATOR'S FEE AND EXPENSES, COURT REPORTER, COURTROOM OR SITE SELECTED, ETC., SHALL BE BORNE EQUALLY BETWEEN THE PARTIES. EITHER PARTY DESIRING A COPY OF THE TRANSCRIPT SHALL PAY FOR THE TRANSCRIPT. A HEARING WILL BE HELD AS SOON AS THE PARTIES CAN MUTUALLY AGREE. A WRITTEN ARBITRATOR'S DECISION WILL BE REQUESTED NOT LATER THAN 30 DAYS FOLLOWING THE HEARING. THE DECISION OF THE ARBITRATOR WILL NOT BE BINDING; HOWEVER, IT WILL BE ADMISSIBLE IN ANY SUBSEQUENT APPEAL UNDER THE CONTRACT DISPUTES ACT.

A FRAMED COPY OF THIS WARRANTY SHALL BE POSTED IN THE MECHANICAL ROOM OR OTHER APPROVED LOCATION DURING THE ENTIRE WARRANTY PERIOD.

-- End of Section --

## SECTION 07530

## ELASTOMERIC ROOFING (EPDM)

09/95

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29/C 29M	(1991a) Unit Weight and Voids in Aggregate
ASTM D 448	(1986; R 1993) Sizes of Aggregate for Road and Bridge Construction
ASTM D 4637	(1996) EPDM Sheet Used in Single-Ply Roof Membrane
ASTM E 108	(1996) Fire Tests of Roof Coverings

## FACTORY MUTUAL ENGINEERING AND RESEARCH (FM)

FM P9513	(1996) Loss Prevention Data for Roofing Contractors
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## SINGLE PLY ROOFING INSTITUTE (SPRI)

SPRI ANSI/SPRI RP-4	(1997) Wind Design Standard for Ballasted Single-Ply Roofing Systems
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## UNDERWRITERS LABORATORIES (UL)

UL 580	(1994; Rev thru Sep 1997) Tests for Uplift Resistance of Roof Assemblies
UL 790	(1995) Tests for Fire Resistance of Roof Covering Materials
UL 1256	(1993; Rev thru Apr 1996) Fire Test of Roof Deck Constructions

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates,



diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-02 Drawings

Roofing System; GA-RE.

Drawings showing size of sheets, position of sheets and splices, flashing details, fastening patterns where applicable for insulation and membrane sheets, and expansion joint details. Detail showing construction of water cutoffs to be used at membrane terminations at the end of a day's work to seal the roofing system from water intrusion.

#### SD-07 Certificates

##### Materials

Certificates of compliance attesting that the roofing system and materials meet specification requirements. The certificates shall list the components required for the specified fire and wind uplift resistance ratings.

#### SD-08 Manufacturer's Instructions

##### Installation

Manufacturer's instructions for preparing and installing the membrane, flashings, seams, insulation, nailers and other accessories.

### 1.3 GENERAL REQUIREMENTS

Elastomeric membrane roofing shall be fully adhered to the roof surfaces indicated. Roofing membrane sheet widths shall be consistent with membrane attachment methods and wind uplift requirements, and shall be as large as practical to minimize joints. Membrane shall be free of defects and foreign material. Flashing work shall be coordinated to permit continuous membrane installation operations. Applied insulation shall be weatherproofed by the membrane on the same day.

#### 1.3.1 Delivery and Storage

Materials shall be delivered to the jobsite in the manufacturer's original, unopened packages, clearly marked with the manufacturer's name, brand name, and description of contents. Materials other than ballast shall be stored in clean, dry areas. Storage temperatures shall be as specified by the manufacturer. Materials other than ballast stored on the roof shall not exceed one day's supply and shall be distributed so as not to exceed the roof live load capacity. Ballast shall be stored uncovered, shall not be in contact with sod or earth, and shall not be stored on the roof.

### 1.3.2 Fire Resistance

The completed roof system shall have a ASTM E 108 (same test as UL 790 and FM P9513, Appendix A) Class A classification, and meet fire test requirements of UL 1256 or FM P9513, Appendix B for roof deck construction. Compliance of each component of the roofing system shall be evidenced by label or by written certification from the manufacturer.

### 1.3.3 Wind Uplift Requirements

Fully adhered roofing systems shall have a 90 Class Rating or FM P9513, Appendix C Windstorm Classification. Ratings from other independent laboratories may be substituted provided that the tests, requirements and ratings are documented to be equivalent, to the satisfaction of the Contracting Officer.

### 1.3.4 Warranty

Manufacturer's standard warranty for the roofing system shall be provided for not less than 10 \_\_\_\_ years from acceptance of the work. Warranty shall state that manufacturer shall repair or replace defective materials if the roofing system leaks or allows the insulation beneath the membrane to become wet during the period of the warranty.

## PART 2 PRODUCTS

### 2.1 ADHESIVES

Adhesives, splicing cements, solvents, and sealants shall be as recommended by the membrane manufacturer.

### 2.2 FASTENERS

Fasteners for sheet-metal flashing shall be corrosion resistant steel annular-type nails or screws. Fasteners for anchoring the roofing membrane shall be as approved by the membrane manufacturer and identical to those used to obtain the wind uplift rating.

### 2.3 FLASHING

Flashing shall be of ultra-violet resistant materials as recommended by the membrane manufacturer. Prefabricated shaped flashings shall be used where possible. Sheared edges of metal flashings that contact the membrane shall be turned into a tight hem.

### 2.4 MEMBRANE

Membrane shall conform to ASTM D 4637, Type I EPDM, Grade 1; Class U, 1.52 mm minimum thickness.

### 2.5 PREFABRICATED ACCESSORIES

Pipe seals and expansion joint covers shall be types and sizes recommended by the membrane manufacturer.

## 2.6 WALKWAYS

Walkways shall be concrete pavers, 200 x 400 mm 38 mm minimum thickness, and made from 21 MPaa air entrained concrete per Section 03300 CAST-IN-PLACE STRUCTURAL CONCRETE. Pavers for walkways less than 1.2 m wide may rest directly on the membrane unless underlayment is recommended by the manufacturer. Where drainage would be blocked by walkway pavers, spaces shall be provided between or below pavers to facilitate drainage. If spaces are provided between pavers, they shall be at least 25 mm wide and no more than 0.6 m apart. Space below pavers shall be provided by using pavers with drainage channels or by elevating flat bottom pavers on pedestals. Alternative walkway material may be used if recommended by the manufacturer and approved by the Contracting Officer.

## PART 3 EXECUTION

### 3.1 ENVIRONMENTAL CONDITIONS

Membrane shall not be installed in high wind, inclement weather or when there is visible ice, frost or moisture on the deck, insulation or membrane. Membrane shall not be installed when air temperature is below the minimum specified by the membrane manufacturer.

### 3.2 PREPARATION

The substrate of any bay or section of the building shall be complete and suitable for insulation and membrane installation before roofing is begun. Insulation over which elastomeric roofing is installed shall conform to Section 07220 ROOF INSULATION. Surfaces against which membrane is applied shall be smooth, clean, and free from dirt, water, dew, oil, grease, sharp edges and construction debris; all joints over 6 mm wide shall be sealed; joints over 13 mm between insulation boards shall be filled with the same insulation. Wood nailers shall comply with Section 06100 ROUGH CARPENTRY.

### 3.3 INSTALLATION

Installation shall comply with the manufacturer's approved instructions, except as otherwise specified.

#### 3.3.1 Flashing

Edges of membrane, projections through the roof and changes in roof planes shall be flashed. The flashing material shall be extended and sealed a minimum of 75 mm on each side of the fasteners which attach the membrane to nailers. The installed flashing shall be fastened at the top of the flashing a maximum of 300 mm on center under metal counter-flashing or cap.

#### 3.3.2 Expansion Joints

Expansion joints shall be covered using prefabricated covers or elastomeric flashing in accordance with the manufacturer's recommendations.

#### 3.3.3 Membrane

Membrane shall be applied in accordance with the manufacturer's instructions and the following requirements. Adjoining sheets comprising the membrane shall be adhered one to another using a butyl-based contact adhesive. Minimum width of the laps shall be 75 mm. A primer shall be used before applying the contact adhesive if required by the membrane manufacturer. In applying the contact adhesive, the minimum thickness of the wet film shall be in accordance with the membrane manufacturer's recommendations. If manufacturer's recommendations are not available, the minimum thickness shall be 0.6 mm. A wet film thickness gage shall be used to determine wet film thickness. Direction of lap shall be such that water flows over lap. Membrane joints shall be free of wrinkles or fishmouths. Before application of the contact adhesive, the rubber surfaces to be mated shall be well cleaned. Joints shall be inspected over entire length after completion and defective areas shall be resealed and patched. Damaged areas of membrane shall be removed and replaced with new materials, lapping underlying membrane by at least 75 mm on all sides.

#### 3.3.4 Cutoffs

Cutoffs shall be installed if work day is ended or interrupted by bad weather before roof section is complete. The insulation line shall be straightened using loose-laid cut insulation and the membrane shall be sealed to the roof deck. Flutes in metal decking shall be sealed off along the cutoff edge. Membrane shall be pulled free or cut to expose the insulation when resuming work, and cut insulation sheets used for fill-in shall be removed as necessary to maintain the staggered pattern.

#### 3.3.5 Walkways

Concrete paver walkways shall be installed on a loose-laid pad of the membrane material extending at least 25 mm beyond the walkway material, and as specified by the manufacturer. Stone ballast shall not be placed below or above walkways.

### 3.4 PROTECTION OF FINISHED ROOFING

The roofing membrane shall be protected from damage by other trades. After completion of work by other trades, the protection shall be removed and the roof shall be inspected. Any damage shall be repaired in accordance with the recommendations of the roofing manufacturer.

### 3.5 INSPECTION

The Contractor shall establish and maintain an inspection procedure to assure compliance of the installed elastomeric roofing with the contract requirements. The procedure shall include a checklist of points to be observed. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of roofing workers; start and end time of various tasks; condition of substrate.

- b. Verification of compliance of materials before, during and after installation.
- c. Inspection of insulation, nailers, flashings, penetrations and work requiring coordination with roofing.
- d. Inspection of membrane placement, splicing, and attachment.
- e. Inspection of placement of walkways.

-- End of Section --

## SECTION 07600

SHEET METALWORK, GENERAL  
04/00

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 167	(1999) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip
ASTM B 32	(1996) Solder Metal
ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(1995) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 221	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 221M	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM B 370	(1998) Copper Sheet and Strip for Building Construction
ASTM D 226	(1997a) Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D 543	(1995) Evaluating the Resistance of Plastics to Chemical Reagents
ASTM D 822	(1996) Conducting Tests on Paint and Related Coatings and Materials Using Filtered Open-Flame Carbon-Arc Exposure Apparatus
ASTM D 828	(1997) Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation-Apparatus
ASTM D 1784	(1999a) Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride)

## (CPVC) Compounds

ASTM D 2822	(1991; R 1997el) Asphalt Roof Cement
ASTM D 3656	(1997) Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns
ASTM D 4022	(1994) Coal Tar Roof Cement, Asbestos Containing
ASTM D 4586	(1993) Asphalt Roof Cement, Asbestos Free
ASTM E 96	(1995) Water Vapor Transmission of Materials

## INSECT SCREENING WEAVERS ASSOCIATION (ISWA)

ISWA IWS 089	(1990) Recommended Standards and Specifications for Insect Wire Screening (Wire Fabric)
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## SHEET METAL &amp; AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA Arch. Manual	(1993; Errata; Addenda Oct 1997) Architectural Sheet Metal Manual
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## 1.2 GENERAL REQUIREMENTS

Sheet metalwork shall be accomplished to form weathertight construction without waves, warps, buckles, fastening stresses or distortion, and shall allow for expansion and contraction. Cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades shall be performed by sheet metal mechanics. Installation of sheet metal items used in conjunction with roofing shall be coordinated with roofing work to permit continuous roofing operations. Sheet metalwork pertaining to heating, ventilating, and air conditioning is specified in Section 15950.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

## SD-02 Shop Drawings

## Materials; GA-RE

Drawings of sheet metal items showing weights, gauges or thicknesses; types of materials; expansion-joint spacing; fabrication details; and installation procedures.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

Materials shall be adequately packaged and protected during shipment and shall be inspected for damage, dampness, and wet-storage stains upon delivery to the jobsite. Materials shall be clearly labeled as to type and manufacturer. Sheet metal items shall be carefully handled to avoid damage.

Materials shall be stored in dry, ventilated areas until immediately before installation.

### PART 2 PRODUCTS

#### 2.1 MATERIALS

Lead, lead-coated metal, and galvanized steel shall not be used. Any metal listed by SMACNA Arch. Manual for a particular item may be used, unless otherwise specified or indicated. Materials shall conform to the requirements specified below and to the thicknesses and configurations established in SMACNA Arch. Manual. Different items need not be of the same metal, except that if copper is selected for any exposed item, all exposed items shall be copper.

##### 2.1.1 Accessories

Accessories and other items essential to complete the sheet metal installation, though not specifically indicated or specified, shall be provided.

##### 2.1.2 Aluminum Extrusions

ASTM B 221M, Alloy 6063, Temper T5.

##### 2.1.3 Bituminous Cement

Type I asphalt cement conforming to ASTM D 2822 or ASTM D 4586.

##### 2.1.4 Sealant

Unless otherwise specified, sealant shall be an elastomeric weather resistant sealant as specified in Section 07900 JOINT SEALING.

##### 2.1.5 Fasteners

Fasteners shall be compatible with the fastened material and shall be the type best suited for the application.

##### 2.1.6 Felt

ASTM D 226, Type I.

##### 2.1.7 Polyvinyl Chloride (PVC) Reglets

ASTM D 1784, Class 14333D, 1.9 mm minimum thickness.

##### 2.1.8 Aluminum Alloy Sheet and Plate



ASTM B 209M clad, form, alloy, and temper appropriate for use.

#### 2.1.9 Copper

ASTM B 370, Temper H 00.

#### 2.1.10 Stainless Steel

ASTM A 167, Type 302 or 304; fully annealed, dead soft temper.

#### 2.1.11 Solder

ASTM B 32, 95-5 tin-antimony.

#### 2.1.12 Through-Wall Flashing

- a. Nonreinforced, waterproof, impermeable extruded elastomeric single ply sheeting not less than 0.76 mm thick.
- b. Other through-wall flashing material may be used provided the following performance criteria are met.
  - (1) No cracking or flaking when bent 180 degrees over a 0.8 mm mandrel and rebent at the same point over the same mandrel in an opposite direction at 0 degree C.
  - (2) Water vapor permeability not more than 115 ng per Paper second per square meter (2 perms) when tested in accordance with ASTM E 96.
  - (3) Minimum breaking strength of 24 kgf/15 mm width in the weakest direction when tested in accordance with ASTM D 828.
  - (4) No visible deterioration after being subjected to a 400-hour direct weathering test in accordance with ASTM D 822.
  - (5) No shrinkage in length or width and less than 5 percent loss of breaking strength after a 10-day immersion, per ASTM D 543, in 5 percent (by weight) solutions, respectively, of sulfuric acid, hydrochloric acid, sodium hydroxide or saturated lime (calcium hydroxide).

#### 2.1.13 Louver Screen

Type II carbon steel Type III aluminum alloy insect screening conforming to ISWA IWS 089 or Plastic-coated glass fiber mesh and louver cloth conforming to ASTM D 3656.

### PART 3 EXECUTION

#### 3.1 GENERAL REQUIREMENTS

Gutters and downspouts shall be designed and fabricated in conformance with SMACNA Arch. Manual; louvers shall be fabricated in conformance with SMACNA

Arch. Manual and as indicated. Unless otherwise specified or indicated, exposed edges shall be folded back to form a 13 mm (1/2 inch) hem on the concealed side, and bottom edges of exposed vertical surfaces shall be angled to form drips. Bituminous cement shall not be placed in contact with roofing membranes other than built-up roofing.

### 3.2 EXPANSION JOINTS

Expansion joints shall be provided as indicated specified in SMACNA Arch. Manual. Expansion joints in continuous sheet metal shall be provided at 12.0 meter intervals for copper and stainless steel and at 9.6 meter intervals for aluminum, except extruded aluminum gravel stops and fasciae which shall have expansion joints at not more than 3.6 meter spacing. Joints shall be evenly spaced. An additional joint shall be provided where the distance between the last expansion joint and the end of the continuous run is more than half the required interval spacing.

### 3.3 PROTECTION OF ALUMINUM

Aluminum shall not be used where it will be in contact with copper or where it will contact water which flows over copper surfaces. Aluminum that will be in contact with wet or pressure-treated wood, mortar, concrete, masonry, or ferrous metals shall be protected against galvanic or corrosive action by one of the following methods:

#### 3.3.1 Paint

Aluminum surfaces shall be solvent cleaned and given one coat of zinc-molybdate primer and one coat of aluminum paint as specified in Section 09900 PAINTING, GENERAL.

#### 3.3.2 Nonabsorptive Tape or Gasket

Nonabsorptive tape or gasket shall be placed between the adjoining surfaces and cemented to the aluminum surface using a cement compatible with aluminum.

### 3.4 CONNECTIONS AND JOINTING

#### 3.4.1 Soldering

Soldering shall apply to copper, and stainless steel items. Edges of sheet metal shall be pretinned before soldering is begun. Soldering shall be done slowly with well heated soldering irons so as to thoroughly heat the seams and completely sweat the solder through the full width of the seam. Edges of stainless steel to be pretinned shall be treated with soldering acid flux. Soldering shall follow immediately after application of the flux. Upon completion of soldering, the acid flux residue shall be thoroughly cleaned from the sheet metal with a water solution of washing soda and rinsed with clean water.

#### 3.4.2 Riveting

Joints in aluminum sheets 1.0 mm or less in thickness shall be mechanically made.

### 3.4.3 Seaming

Flat-lock and soldered-lap seams shall finish not less than 25 mm wide. Unsoldered plain-lap seams shall lap not less than 75 mm unless otherwise specified. Flat seams shall be made in the direction of the flow.

### 3.5 CLEATS

A continuous cleat shall be provided where indicated or specified to secure loose edges of the sheet metalwork. Butt joints of cleats shall be spaced approximately 3 mm apart. The cleat shall be fastened to supporting wood construction with nails evenly spaced not over 300 mm on centers. Where the fastening is to be made to concrete or masonry, screws shall be used and shall be driven in expansion shields set in concrete or masonry.

### 3.6 GUTTERS AND DOWNSPOUTS

Gutters and downspouts shall be installed as indicated. Gutters shall be supported by continuous cleats] or] by cleats spaced not less than 915 mm (36 inches) apart. Downspouts shall be rigidly attached to the building. Supports for downspouts shall be spaced according to manufacturer's recommendations.

#### 3.6.1 Gutter Baffles

Gutter baffles shall be formed and installed in accordance with SMACNA-02 at all valley locations. Gutter baffles shall extend 150 mm above the front edge of the gutter. Metal screws or rivets shall be used to secure the baffle to the gutter bead.

### 3.7 FLASHINGS

Flashings shall be installed at locations indicated and as specified below. Sealing shall be according to the flashing manufacturer's recommendations. Flashings shall be installed at intersections of roof with vertical surfaces and at projections through roof, except that flashing for heating and plumbing, including piping, roof, and floor drains, and for electrical conduit projections through roof or walls are specified in other sections. Except as otherwise indicated, counter flashings shall be provided over base flashings. Perforations in flashings made by masonry anchors shall be covered up by an application of bituminous plastic cement at the perforation. Flashing shall be installed on top of joint reinforcement. Flashing shall be formed to direct water to the outside of the system.

#### 3.7.1 Base Flashing

Metal base flashing shall be coordinated with roofing work. Metal base flashing shall be set in plastic bituminous cement over the roofing membrane, nailed to nailing strip, and secured in place on the roof side with nails spaced not more than 75 mm on centers. Metal base flashing shall not be used on built-up roofing.

#### 3.7.2 Counter Flashings

Except as otherwise indicated, counter flashings shall be provided over base flashings. Counter flashing shall be installed as shown on the drawings. Where bituminous base flashings are provided, the counter flashing shall extend down as close as practicable to the top of the cant strip. Counter flashing shall be factory formed to provide spring action against the base flashing.

### 3.7.3 Through-Wall Flashing

Through-wall flashing includes sill, lintel, and spandrel flashing. The flashing shall be laid with a layer of mortar above and below the flashing so that the total thickness of the two layers of the mortar and flashing are the same thickness as the regular mortar joints. Flashing shall not extend further into the masonry backup wall than the first mortar joint. Joints in flashing shall be lapped and sealed. Flashing shall be one piece for lintels and sills.

#### 3.7.3.1 Lintel Flashing

Lintel flashing shall extend the full length of lintel. Flashing shall extend through the wall one masonry course above the lintels and shall be bent down over the vertical leg of the outer steel lintel angle not less than 50 mm, or shall be applied over top of masonry and precast concrete lintels. Bedjoints of lintels at control joints shall be underlaid with sheet metal bond breaker.

#### 3.7.3.2 Sill Flashing

Sill flashing shall extend the full width of the sill and not less than 100 mm beyond ends of sill except at control joint where the flashing shall be terminated at the end of the sill.

### 3.7.4 Valley Flashing

Valley flashing shall be installed as specified in SMACNA Arch. Manual and as indicated.

## 3.8 GRAVEL STOPS AND FASCIA

Gravel stops and fascia shall be fabricated and installed as indicated and in accordance with SMACNA Arch. Manual.

## 3.9 INSTALLATION OF LOUVERS

Louvers shall be rigidly attached to the supporting construction. The installation shall be rain-tight. Louver screen shall be installed as indicated.

## 3.10 REGLETS

Reglets shall be a factory fabricated product of proven design, complete with fittings and special shapes as required. Open-type reglets shall be filled with fiberboard or other suitable separator to prevent crushing of

the slot during installation. Reglet plugs shall be spaced not over 300 mm on centers and reglet grooves shall be filled with sealant. Friction or slot-type reglets shall have metal flashings inserted the full depth of slot and shall be lightly punched every 300 mm to crimp the reglet and counter flashing together. Polyvinyl chloride reglets shall be sealed with the manufacturer's recommended sealant.

### 3.11 CONTRACTOR QUALITY CONTROL

The Contractor shall establish and maintain a quality control procedure for sheet metal used in conjunction with roofing to assure compliance of the installed sheet metalwork with the contract requirements. Any work found not to be in compliance with the contract shall be promptly removed and replaced or corrected in an approved manner. Quality control shall include, but not be limited to, the following:

- a. Observation of environmental conditions; number and skill level of sheet metal workers; condition of substrate.
- b. Verification of compliance of materials before, during, and after installation.
- c. Inspection of sheet metalwork for proper size and thickness, fastening and joining, and proper installation.

The actual quality control observations and inspections shall be documented and a copy of the documentation furnished to the Contracting Officer at the end of each day.

-- End of Section --

## SECTION 07840

## FIRESTOPPING

05/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84	(1996a) Surface Burning Characteristics of Building Materials
ASTM E 119	(1995a) Fire Tests of Building Construction and Materials
ASTM E 814	(1994b) Fire Tests of Through-Penetration Fire Stops

## UNDERWRITERS LABORATORIES (UL)

UL 723	(1996) Test for Surface Burning Characteristics of Building Materials
UL 1479	(1994; Rev thru Jul 1997) Fire Tests of Through-Penetration Firestops
UL 2079	(1997) Tests for Fire Resistance of Building Joint Systems
UL Fire Resist Dir	(1997) Fire Resistance Directory

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

## SD-02 Shop Drawings

## Firestopping Materials; GA-RE.

Detail drawings including manufacturer's descriptive data, typical details, installation instructions and the fire-test data and/or report as appropriate for the fire resistance rated construction and location. Submittal shall indicate the firestopping material to be provided for each type of application. When more than 5 penetrations or construction joints are to receive firestopping, drawings shall indicate location and type of application.

## SD-07 Certificates

## Firestopping Materials

Certificates attesting that firestopping material complies with the specified requirements. The label or listing of the Underwriters Laboratories will be acceptable evidence. In lieu of the label or listing, a written certificate may be submitted from an approved, nationally recognized testing agency equipped to perform such services, stating that the items have been tested and conform to the specified requirements and testing methods.

## Installer Qualifications

Documentation of training and experience.

## Inspection

Manufacturer's representative certification stating that firestopping work has been inspected and found to be applied according to the manufacturer's recommendations and the specified requirements.

## 1.3 GENERAL REQUIREMENTS

Firestopping shall consist of furnishing and installing a material or a combination of materials to form an effective barrier against the spread of flame, smoke and gases, and maintain the integrity of fire resistance rated walls, partitions, floors, and ceiling-floor assemblies, including through-penetrations and construction joints. Through-penetrations include the annular space around pipes, tubes, conduit, wires, cables and vents. Construction joints include those used to accommodate expansion, contraction, wind, or seismic movement; firestopping material shall not interfere with the required movement of the joint. Gaps requiring firestopping include gaps between the curtain wall and the floor slab and between the top of the fire-rated walls and the roof deck.

## 1.4 STORAGE AND DELIVERY

Materials shall be delivered in the original unopened packages or containers showing name of the manufacturer and the brand name. Materials shall be stored off the ground and shall be protected from damage and exposure to

elements. Damaged or deteriorated materials shall be removed from the site.

#### 1.5 INSTALLER QUALIFICATIONS

Installer of firestopping material shall be trained by the manufacturer or the manufacturer's representative, and shall have a minimum of 3 years experience in the installation of firestopping of the type specified.

### PART 2 PRODUCTS

#### 2.1 FIRESTOPPING MATERIALS

Firestopping materials shall consist of commercially manufactured products complying with the following minimum requirements:

##### 2.1.1 Fire Hazard Classification

Material shall have a flame spread of 25 or less, and a smoke developed rating of 50 or less, when tested in accordance with ASTM E 84 or UL 723. Material shall be an approved firestopping material as listed in UL Fire Resist Dir or by a nationally recognized testing laboratory.

##### 2.1.2 Toxicity

Material shall be nontoxic to humans at all stages of application.

##### 2.1.3 Fire Resistance Rating

Firestopping will not be required to have a greater fire resistance rating than that of the assembly in which it is being placed.

##### 2.1.3.1 Through-Penetrations

Firestopping materials for through-penetrations, as described in paragraph GENERAL REQUIREMENTS, shall provide "F" and "T" fire resistance ratings in accordance with ASTM E 814 or UL 1479, except that T Ratings are not required for penetrations smaller than or equal to a 100 mm nominal pipe or 0.01 square meter in overall cross sectional area. Fire resistance ratings shall be the following:

- a. Penetrations of Fire Resistance Rated Walls and Partitions: F Rating = 1 hour, T Rating = 1 hour.
- b. Penetrations of Fire Resistance Rated Floors and Ceiling-Floor Assemblies: F Rating = 1 hour, T Rating = 1 hour.

##### 2.1.3.2 Construction Joints and Gaps

Fire resistance ratings of construction joints, as described in paragraph GENERAL REQUIREMENTS, and gaps such as those between floor slabs or roof decks and curtain walls shall be as follows: construction joints in walls, 1 hour; construction joints in floors, 1 hour; gaps between floor slabs and curtain walls, 1 hour; gaps between top of the walls and the bottom of roof decks, 1 hour. Construction joints and gaps shall be provided with



firestopping materials and systems that have been tested per ASTM E 119 or UL 2079 to meet the required fire resistance rating.

### PART 3 EXECUTION

#### 3.1 PREPARATION

Areas to receive firestopping shall be free of dirt, grease, oil, or loose materials which may affect the fitting or fire resistance of the firestopping system.

#### 3.2 INSTALLATION

Firestopping material shall completely fill void spaces regardless of geometric configuration, subject to tolerance established by the manufacturer. Firestopping for filling floor voids 100 mm or more in any direction shall be capable of supporting the same load as the floor is designed to support or shall be protected by a permanent barrier to prevent loading or traffic in the firestopped area. Firestopping shall be installed in accordance with manufacturer's written instructions. Firestopping shall be provided in the following locations, except in floor slabs on grade:

- a. Penetrations of duct, conduit, tubing, cable and pipe through floors and through fire-resistance rated walls, partitions, and ceiling-floor assemblies.
- b. Penetrations of vertical shafts such as pipe chases, elevator shafts, and utility chutes.
- c. Gaps at the intersection of floor slabs and curtain walls, including inside of hollow curtain walls at the floor slab.
- d. Gaps at perimeter of fire-resistance rated walls and partitions, such as between the top of the walls and the bottom of roof decks.
- e. Construction joints in floors and fire rated walls and partitions.
- f. Other locations where required to maintain fire resistance rating of the construction.

#### 3.3 INSPECTION

Firestopped areas shall not be covered or enclosed until inspection is complete and approved. A manufacturer's representative shall inspect the applications initially to ensure adequate preparations (clean surfaces suitable for application, etc.) and periodically during the work to assure that the completed work has been accomplished according to the manufacturer's written instructions and the specified requirements.

-- End of Section --

## SECTION 07900

JOINT SEALING  
06/97

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 509	(1994) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C 570	(1995) Oil- and Resin-Base Caulking Compound for Building Construction
ASTM C 734	(1993) Low-Temperature Flexibility of Latex Sealants After Artificial Weathering
ASTM C 834	(1995) Latex Sealants
ASTM C 920	(1998) Elastomeric Joint Sealants
ASTM C 1085	(1991) Butyl Rubber-Based Solvent-Release Sealants
ASTM C 1184	(1995el) Structural Silicone-Sealants
ASTM D 217	(1997) Cone Penetration of Lubricating Grease (IP50/88)
ASTM D 1056	(1998) Flexible Cellular Materials - Sponge or Expanded Rubber
ASTM D 1565	(1999) Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Open-Cell Foam)
ASTM E 84	(1999) Surface Burning Characteristics of Building Materials

## 1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that

will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

#### SD-03 Product Data

Backing

Bond-Breaker

Sealant

Manufacturer's descriptive data including storage requirements, shelf life, curing time, instructions for mixing and application, and primer data (if required). A copy of the Material Safety Data Sheet shall be provided for each solvent, primer or sealant material.

#### SD-07 Certificates

Sealant

Certificates of compliance stating that the materials conform to the specified requirements.

### 1.3 ENVIRONMENTAL REQUIREMENTS

The ambient temperature shall be within the limits of 4 to 32 degrees C when the sealants are applied.

### 1.4 DELIVERY AND STORAGE

Materials shall be delivered to the job in the manufacturer's original unopened containers. The container label or accompanying data sheet shall include the following information as applicable: manufacturer, name of material, formula or specification number, lot number, color, date of manufacture, mixing instructions, shelf life, and curing time at the standard conditions for laboratory tests. Materials shall be handled and stored to prevent inclusion of foreign materials. Materials shall be stored at temperatures between 4 and 32 degrees C unless otherwise specified by the manufacturer.

## PART 2 PRODUCTS

### 2.1 BACKING

Backing shall be 25 to 33 percent oversize for closed cell and 40 to 50 percent oversize for open cell material, unless otherwise indicated.

#### 2.1.1 Rubber

Cellular rubber sponge backing shall be ASTM D 1056, Type 2, closed cell, Class A, Grade 1, round cross section.

#### 2.1.2 Synthetic Rubber

Synthetic rubber backing shall be ASTM C 509, Option I, Type I preformed rods or tubes.

#### 2.1.3 Neoprene

Neoprene backing shall be ASTM D 1056, closed cell expanded neoprene cord Type 2, Class C, Grade 2C2.

#### 2.2 BOND-BREAKER

Bond-breaker shall be as recommended by the sealant manufacturer to prevent adhesion of the sealant to backing or to bottom of the joint.

#### 2.3 PRIMER

Primer shall be non-staining type as recommended by sealant manufacturer for the application.

#### 2.4 CAULKING

Oil- and resin-based caulking shall be ASTM C 570, Type 1, Use only indoors and where there is no anticipated movement.

#### 2.5 SEALANT

##### 2.5.1 LATEX

Latex Sealant shall be ASTM C 834.

##### 2.5.2 ELASTOMERIC

Elastomeric sealants shall conform to ASTM C 920 and the following:

- a. Polysulfide Sealant: Type S, Grade NS, Class 25, Use NT, G A O.
- b. Polyurethane sealant: Grade NS, Class 25, Use G A O.
- c. Silicone sealant: Type S, Grade NS, Class 25, Use NT, M G A O.
- d. Structural silicone sealant: ASTM C 1184, Type S, Use G O.

##### 2.5.3 ACOUSTICAL

Rubber or polymer-based acoustical sealant shall have a flame spread of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E 84. Acoustical sealant shall have a consistency of 250 to 310 when tested in accordance with ASTM D 217, and shall remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C 734, and shall be non-staining.

##### 2.5.4 BUTYL

Butyl sealant shall be ASTM C 1085.

## 2.5.5 PREFORMED

Preformed sealant shall be polybutylene or isoprene-butylene based pressure sensitive weather resistant tape or bead sealant capable of sealing out moisture, air and dust when installed as recommended by the manufacturer. At temperatures from minus 34 to plus 71 degrees C, the sealant shall be non-bleeding and shall have no loss of adhesion.

### 2.5.5.1 Foam Strip

Foam strip shall be polyurethane foam. Foam strip shall be capable of sealing out moisture, air, and dust when installed and compressed as recommended by the manufacturer. Service temperature shall be minus 40 to plus 135 degrees C. Untreated strips shall be furnished with adhesive to hold them in place. Adhesive shall not stain or bleed into adjacent finishes. Treated strips shall be saturated with butylene waterproofing or impregnated with asphalt.

## 2.6 SOLVENTS AND CLEANING AGENTS

Solvents, cleaning agents, and accessory materials shall be provided as recommended by the manufacturer.

## PART 3 EXECUTION

### 3.1 GENERAL

#### 3.1.1 Surface Preparation

The surfaces of joints to receive sealant or caulk shall be free of all frost, condensation and moisture. Oil, grease, dirt, chalk, particles of mortar, dust, loose rust, loose mill scale, and other foreign substances shall be removed from surfaces of joints to be in contact with the sealant. Oil and grease shall be removed with solvent and surfaces shall be wiped dry with clean cloths. For surface types not listed below, the sealant manufacturer shall be contacted for specific recommendations.

#### 3.1.2 Concrete and Masonry Surfaces

Where surfaces have been treated with curing compounds, oil, or other such materials, the materials shall be removed by sandblasting or wire brushing. Laitance, efflorescence and loose mortar shall be removed from the joint cavity.

#### 3.1.3 Steel Surfaces

Steel surfaces to be in contact with sealant shall be sandblasted or, if sandblasting would not be practical or would damage adjacent finish work, the metal shall be scraped and wire brushed to remove loose mill scale. Protective coatings on steel surfaces shall be removed by sandblasting or by a solvent that leaves no residue.

#### 3.1.4 Aluminum Surfaces

Aluminum surfaces to be in contact with sealants shall be cleaned of temporary protective coatings. When masking tape is used for a protective cover, the tape and any residual adhesive shall be removed just prior to applying the sealant. Solvents used to remove protective coating shall be as recommended by the manufacturer of the aluminum work and shall be non-staining.

#### 3.1.5 Wood Surfaces

Wood surfaces to be in contact with sealants shall be free of splinters and sawdust or other loose particles.

### 3.2 APPLICATION

#### 3.2.1 Masking Tape

Masking tape shall be placed on the finish surface on one or both sides of a joint cavity to protect adjacent finish surfaces from primer or sealant smears. Masking tape shall be removed within 10 minutes after joint has been filled and tooled.

#### 3.2.2 Backing

Backing shall be installed to provide the indicated sealant depth. The installation tool shall be shaped to avoid puncturing the backing.

#### 3.2.3 Bond-Breaker

Bond-breaker shall be applied to fully cover the bottom of the joint without contaminating the sides where sealant adhesion is required.

#### 3.2.4 Primer

Primer shall be used on concrete masonry units, wood, or other porous surfaces in accordance with instructions furnished with the sealant. Primer shall be applied to the joint surfaces to be sealed. Surfaces adjacent to joints shall not be primed.

#### 3.2.5 Sealant

Sealant shall be used before expiration of shelf life. Multi-component sealants shall be mixed according to manufacturer's printed instructions. Sealant in guns shall be applied with a nozzle of proper size to fit the width of joint. Joints shall be sealed as detailed in the drawings. Sealant shall be forced into joints with sufficient pressure to expel air and fill the groove solidly. Sealant shall be installed to the indicated depth without displacing the backing. Unless otherwise indicated, specified, or recommended by the manufacturer, the installed sealant shall be dry tooled to produce a uniformly smooth surface free of wrinkles and to ensure full adhesion to the sides of the joint; the use of solvents, soapy water, etc., will not be allowed. Sealants shall be installed free of air pockets, foreign embedded matter, ridges and sags. Sealer shall be applied over the sealant when and as specified by the sealant manufacturer.

### 3.3 CLEANING

The surfaces adjoining the sealed joints shall be cleaned of smears and other soiling resulting from the sealant application as work progresses.

-- End of Section --

DIVISION 8 – DOORS AND WINDOWS

08110	Steel Doors and Frames
08120	Aluminum Doors and Frames
08210	Wood Doors
08330	Overhead Rolling Doors
08331	Metal Rolling Counter Doors
08353	Accordion Partitions
08361	Sectional Overhead Doors
08520	Aluminum Windows
08700	Builders' Hardware
08810	Glass and Glazing



## SECTION 08110

## STEEL DOORS AND FRAMES

05/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A250.3	(1999) Test Procedure and Acceptance Criteria for Factory Applied Finish Painted Steel Surfaces for Steel Doors and Frames
ANSI A250.4	(1994) Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings
ANSI A250.6	(1997) Hardware on Standard Steel Doors (Reinforcement - Application)
ANSI A250.8	(1998) SDI-100 Recommended Specifications for Standard Steel Doors and Frames

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 591	(1998) Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications
ASTM A 653/A 653M	(2000) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM A 924/A 924M	(1999) General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process
ASTM C 578	(1995) Rigid, Cellular Polystyrene Thermal Insulation
ASTM C 591	(1994) Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation
ASTM C 612	(1993) Mineral Fiber Block and Board Thermal Insulation

ASTM D 2863 (1997) Measuring the Minimum Oxygen Concentration to Support Candle-Like Combustion of Plastics (Oxygen Index)

ASTM E 283 (1991) Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

#### DOOR AND HARDWARE INSTITUTE (DHI)

ANSI/DHI A115 (1991) Steel Door Preparation Standards (Consisting of A115.1 through A115.6 and A115.12 through A115.18)

#### HOLLOW METAL MANUFACTURERS ASSOCIATION (HMMA)

HMMA HMM (1992) Hollow Metal Manual

#### NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1999) Fire Doors and Fire Windows

NFPA 105 (1999) The Installation of Smoke-Control Door Assemblies

NFPA 252 (1999) Standard Methods of Fire Tests of Door Assemblies

#### STEEL DOOR INSTITUTE (SDOI)

SDI 105 (1998) Recommended Erection Instructions for Steel Frames

SDI 111-B Recommended Standard Details for Dutch Doors

SDI 111-C Recommended Louver Details for Standard Steel Doors

SDI 111-F Recommended Existing Wall Anchors for Standard Steel Doors and Frames

SDI 113 (1979) Apparent Thermal Performance of STEEL DOOR and FRAME ASSEMBLIES

#### UNDERWRITERS LABORATORIES (UL)

UL 10B (1997) Fire Tests of Door Assemblies

### 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ",

including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-02 Shop Drawings

Doors; GA-BK, GA-CH, GA-DN, GA-HQ

Frames; GA-BK, GA-CH, GA-DN, GA-HQ

Accessories

Show elevations, construction details, metal gages, hardware provisions, method of glazing, and installation details.

Schedule of doors

Schedule of frames

Submit door and frame locations.

#### SD-03 Product Data

Doors

Frames

Accessories

Submit manufacturer's descriptive literature for doors, frames, and accessories. Include data and details on door construction, panel (internal) reinforcement, insulation, and door edge construction. When "custom hollow metal doors" are provided in lieu of "standard steel doors," provide additional details and data sufficient for comparison to ANSI A250.8 requirements.

### 1.3 DELIVERY, STORAGE, AND HANDLING

Deliver doors, frames, and accessories undamaged and with protective wrappings or packaging. Provide temporary steel spreaders securely fastened to the bottom of each welded frame. Store doors and frames on platforms under cover in clean, dry, ventilated, and accessible locations, with 6 mm airspace between doors. Remove damp or wet packaging immediately and wipe affected surfaces dry. Replace damaged materials with new.

## PART 2 PRODUCTS

### 2.1 STANDARD STEEL DOORS

ANSI A250.8, except as specified otherwise. Prepare doors to receive hardware specified in Section 08700, "Builders' Hardware." Undercut where indicated. Exterior doors shall have top edge closed flush and sealed to prevent water intrusion. Doors shall be 44.5 mm thick, unless otherwise indicated.

#### 2.1.1 Classification - Level, Performance, Model

##### 2.1.1.1 Standard Duty Doors

ANSI A250.8, Level 1, physical performance Level C, Model 1, of size(s) and design(s) indicated and core construction as required by the manufacturer. Provide where shown.

##### 2.1.1.2 Heavy Duty Doors

ANSI A250.8, Level 2, physical performance Level B, Model 1, with core construction as required by the manufacturer for interior doors of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation. Provide Level II where indicated.

##### 2.1.1.3 Extra Heavy Duty Doors

ANSI A250.8, Level 3, physical performance Level A, Model 1 with core construction as required by the manufacturer for interior doors, of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation. Provide Level 3 where indicated.

##### 2.1.1.4 Maximum Duty Doors

ANSI A250.8, Level 4, physical performance Level A, Model 1 with core construction as required by the manufacturer for interior doors and for indicated exterior doors, of size(s) and design(s) indicated. Where vertical stiffener cores are required, the space between the stiffeners shall be filled with mineral board insulation. Provide Level 4 where indicated.

#### 2.2 INSULATED STEEL DOOR SYSTEMS

At the option of the Contractor, insulated steel doors and frames may be provided in lieu of Grade I standard steel doors and frames. Door size(s), design, and material shall be as specified for standard steel doors. Insulated steel doors shall have a core of polyurethane foam and an R factor of 10.0 or more (based on a k value of 0.16); face sheets, edges, and frames of galvanized steel not lighter than 0.7 mm thick, 1.5 mm thick, and 1.5 mm respectively. Doors and frames shall receive phosphate treatment, rust-inhibitive primer, and baked acrylic enamel finish. Doors shall have been tested in accordance with ANSI A250.4 and shall have met the requirements for Level C. Prepare doors to receive hardware specified in Section 08700, "Builders' Hardware." Doors shall be 44.5 mm thick. Provide insulated steel doors and frames where shown.

## 2.3 ACCESSORIES

### 2.3.1 Shelves for Dutch Doors

SDI 111-B. Fabricate shelves of steel not lighter than 1.5 mm thick, of the size indicated. Brackets shall be stock type fabricated of the same metal used to fabricate shelves.

### 2.3.2 Louvers

#### 2.3.2.1 Exterior Louvers

Louvers shall be inverted "Y" type with minimum of 30 percent net-free opening. Weld or tenon louver blades to continuous channel frame and weld assembly to door to form watertight assembly. Form louvers of hot-dip galvanized steel of same gage as door facings. Louvers shall have steel-framed insect screens secured to room side and readily removable. Provide aluminum wire cloth, 7 by 7 per 10 mm mesh, for insect screens. Net-free louver area to be before screening.

### 2.3.3 Astragals

For pairs of exterior steel doors which will not have aluminum astragals or removable mullions, as specified in Section 08700, "Builders' Hardware," provide overlapping steel astragals with the doors.

### 2.3.4 Moldings

Provide moldings around glass of interior and exterior doors and louvers of interior doors. Provide nonremovable moldings on outside of exterior doors and on corridor side of interior doors. Other moldings may be stationary or removable. Secure inside moldings to stationary moldings, or provide snap-on moldings. Muntins shall interlock at intersections and shall be fitted and welded to stationary moldings.

## 2.4 INSULATION CORES

Insulated cores shall be of type specified, and provide an apparent U-factor of .48 in accordance with SDI 113 and shall conform to:

- a. Rigid Polyurethane Foam: ASTM C 591, Type 1 or 2, foamed-in-place or in board form, with oxygen index of not less than 22 percent when tested in accordance with ASTM D 2863; or
- b. Rigid Polystyrene Foam Board: ASTM C 578, Type I or II; or
- c. Mineral board: ASTM C 612, Type I.

## 2.5 STANDARD STEEL FRAMES

ANSI A250.8, except as otherwise specified. Form frames to sizes and shapes indicated, with welded corners unless otherwise indicated.

### 2.5.1 Welded Frames

Continuously weld frame faces at corner joints. Mechanically interlock or continuously weld stops and rabbets. Grind welds smooth.

#### 2.5.2 Stops and Beads

Form stops and beads from 0.9 mm thick steel. Provide for glazed and other openings in standard steel frames. Secure beads to frames with oval-head, countersunk Phillips self-tapping sheet metal screws or concealed clips and fasteners. Space fasteners approximately 300 to 400 mm on centers. Miter molded shapes at corners. Butt or miter square or rectangular beads at corners.

#### 2.5.3 Anchors

Provide anchors to secure the frame to adjoining construction. Provide steel anchors, zinc-coated or painted with rust-inhibitive paint, not lighter than 1.2 mm thick.

##### 2.5.3.1 Wall Anchors

Provide at least three anchors for each jamb. For frames which are more than 2285 mm in height, provide one additional anchor for each jamb for each additional 760 mm or fraction thereof.

- a. Masonry: Provide anchors of corrugated or perforated steel straps or 5 mm diameter steel wire, adjustable or T-shaped;
- b. Stud partitions: Weld or otherwise securely fasten anchors to backs of frames. Design anchors to be fastened to closed steel studs with sheet metal screws, and to open steel studs by wiring or welding];

##### 2.5.3.2 Floor Anchors

Provide floor anchors drilled for 10 mm anchor bolts at bottom of each jamb member.

#### 2.6 FIRE DOORS AND FRAMES

NFPA 80 and this specification. The requirements of NFPA 80 shall take precedence over details indicated or specified.

##### 2.6.1 Labels

Fire doors and frames shall bear the label of Underwriters Laboratories, Inc. (UL), Factory Mutual Engineering and Research (FM), or Warnock Hersey International (WHI) attesting to the rating required. Testing shall be in accordance with NFPA 252 or UL 10B. Labels shall be metal with raised letters, and shall bear the name or file number of the door and frame manufacturer. Labels shall be permanently affixed at the factory to frames and to the hinge edge of the door. Door labels shall not be painted.

##### 2.6.2 Oversized Doors

For fire doors and frames which exceed the size for which testing and labeling are available, furnish certificates stating that the doors and frames are identical in design, materials, and construction to a door which has been tested and meets the requirements for the class indicated.

### 2.6.3 Astragal on Fire Doors

On pairs of labeled fire doors, conform to NFPA 80 and UL requirements.

## 2.7 WEATHERSTRIPPING

As specified in Section 08700, "Builders' Hardware."

## 2.8 HARDWARE PREPARATION

Provide minimum hardware reinforcing gages as specified in ANSI A250.6. Drill and tap doors and frames to receive finish hardware. Prepare doors and frames for hardware in accordance with the applicable requirements of ANSI A250.8 and ANSI A250.6. For additional requirements refer to ANSI/DHI A115.

Drill and tap for surface-applied hardware at the project site. Build additional reinforcing for surface-applied hardware into the door at the factory. Locate hardware in accordance with the requirements of ANSI A250.8, as applicable. Punch door frames, with the exception of frames that will have weatherstripping to receive a minimum of two rubber or vinyl door silencers on lock side of single doors and one silencer for each leaf at heads of double doors. Set lock strikes out to provide clearance for silencers.

## 2.9 FINISHES

### 2.9.1 Hot-Dip Zinc-Coated and Factory-Primed Finish

Fabricate exterior doors and frames from hot dipped zinc coated steel, alloyed type, that complies with ASTM A 924/A 924M and ASTM A 653/A 653M. The Coating weight shall meet or exceed the minimum requirements for coatings having 122 grams per square meter, total both sides, i.e., ZF120. Repair damaged zinc-coated surfaces by the application of zinc dust paint. Thoroughly clean and chemically treat to insure maximum paint adhesion. Factory prime as specified in ANSI A250.8.

### 2.9.2 Electrolytic Zinc-Coated Anchors and Accessories

Provide electrolytically deposited zinc-coated steel in accordance with ASTM A 591, Commercial Quality, Coating Class A. Phosphate treat and factory prime zinc-coated surfaces as specified in ANSI A250.8.

## 2.10 FABRICATION AND WORKMANSHIP

Finished doors and frames shall be strong and rigid, neat in appearance, and free from defects, waves, scratches, cuts, dents, ridges, holes, warp, and buckle. Molded members shall be clean cut, straight, and true, with joints coped or mitered, well formed, and in true alignment. Dress exposed welded and soldered joints smooth. Design door frame sections for use with the wall construction indicated. Corner joints shall be well formed and in true

alignment. Conceal fastenings where practicable. Design other frames in exposed masonry walls or partitions to allow sufficient space between the inside back of trim and masonry to receive calking compound.

#### 2.10.1 Grouted Frames

For frames to be installed in exterior walls and to be filled with mortar or grout, fill the stops with strips of rigid insulation to keep the grout out of the stops and to facilitate installation of stop-applied head and jamb seals.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Frames

Set frames in accordance with SDI 105. Plumb, align, and brace securely until permanent anchors are set. Anchor bottoms of frames with expansion bolts or powder-actuated fasteners. Build in or secure wall anchors to adjoining construction. Where frames require ceiling struts or overhead bracing, anchor frames to the struts or bracing. Backfill frames with mortar. When an additive is provided in the mortar, coat inside of frames with corrosion-inhibiting bituminous material. For frames in exterior walls, ensure that stops are filled with rigid insulation before grout is placed.

##### 3.1.2 Doors

Hang doors in accordance with clearances specified in ANSI A250.8. After erection and glazing, clean and adjust hardware.

##### 3.1.3 Fire Doors and Frames

Install fire doors and frames, including hardware, in accordance with NFPA 80.

#### 3.2 PROTECTION

Protect doors and frames from damage. Repair damaged doors and frames prior to completion and acceptance of the project or replace with new, as directed. Wire brush rusted frames until rust is removed. Clean thoroughly. Apply an all-over coat of rust-inhibitive paint of the same type used for shop coat.

#### 3.3 CLEANING

Upon completion, clean exposed surfaces of doors and frames thoroughly. Remove mastic smears and other unsightly marks.

#### 3.4 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of inch-pound measurements, and not on metric measurement commonly agreed to by the manufacturers or other parties. The inch-pound



and metric measurements are as follows:

<u>PRODUCT</u>	<u>INCH-POUN</u>	<u>METRIC</u>
Door thickness	1 3/4 inches	44.5 mm
Steel channels	16 gage	1.5 mm
Steel Sheet	23 gage	0.7 mm
	16 gage	1.5 mm
	20 gage	0.9 mm
	18 gage	1.2 mm
Anchor bolts	3/8 inches	10 mm

-- End of Section --

## SECTION 08120

## ALUMINUM DOORS AND FRAMES

07/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA DAF-45 (1980; R 1993) Designation System for Aluminum Finishes

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA 605 (1998) Voluntary Specification for High Performance Organic Coatings on Architectural Aluminum Extrusions and Panels

AAMA 1503.1 (1988) Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM B 209 (1996) Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B 209M (1995) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)

ASTM B 221 (1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

ASTM B 221M (1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

ASTM E 283 (1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

ASTM E 330 (1990) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

ASTM E 331 (1996) Water Penetration of Exterior Windows,

Curtain Walls, and Doors by Uniform Static Air  
Pressure Difference

## 1.2 SYSTEM DESCRIPTION

Frames and swing-type aluminum doors, of size and design shown on the drawings, shall be provided at the locations indicated. Frames shall be furnished complete with doors, subframes, transoms, adjoining sidelights, adjoining window wall system, trim, and other accessories indicated and specified.

## 1.3 PERFORMANCE REQUIREMENTS

### 1.3.1 Wind Load Performance

Doors and frames shall be of sufficient strength to withstand a design wind load of 1440 Pa (30 pounds per square foot) of supported area with a deflection of not more than 1/175 times the length of the member. Doors shall be tested in accordance with ASTM E 330 at a pressure not less than 1.5 times the design load.

### 1.3.2 Water Penetration Performance

Frames and fixed areas, and non-handicap complying doors shall have no water penetration when tested in accordance with ASTM E 331 at a pressure of 383 Pa.

## 1.4 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

### SD-02 Shop Drawings

Aluminum Doors and Frames; GA-BK, GA-DN, GA-HQ.

A schedule showing the location of each door and window wall system shall be included with the drawings. Drawings showing elevations of each door and frame type, details and method of anchorage, details of construction, location and installation of hardware, shape and thickness of materials, and details of joints and connections.

### SD-03 Product Data

Aluminum Doors and Frames; GA-BK, GA-DN, GA-HQ.

Manufacturer's descriptive data and catalog cuts including air-infiltration data.

SD-04 Samples

Finishes; GA-BK, GA-DN, GA-HQ.

Samples of the color anodized coating, showing the extreme color range.

SD-06 Test Reports

Aluminum Doors

For full-glazed and flush doors, certified test reports from an independent testing laboratory, stating that doors are identical in design, materials, and construction to a door that has been tested and meets all test and specified requirements.

SD-08 Manufacturer's Instructions

Installation    Cleaning

Manufacturer's installation instructions and cleaning instructions.

1.5    DELIVERY AND STORAGE

Materials delivered to the jobsite shall be inspected for damage, and shall be unloaded with a minimum of handling. Storage shall be in a dry location with adequate ventilation, free from dust, water, and other contaminants, and which permits easy access for inspecting and handling. Materials shall be neatly stored on the floor, properly stacked on nonabsorptive strips or wood platforms. Doors and frames shall not be covered with tarps, polyethylene film, or similar coverings.

1.6    WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one-year period shall be provided.

PART 2    PRODUCTS

2.1    ALUMINUM DOORS AND FRAMES

Extrusions shall comply with ASTM B 221M , Alloy 6063-T5 or -T6, except alloy used for anodized color coatings shall be required to produce the specified color. Aluminum sheets and strips shall comply with ASTM B 209M , alloy and temper best suited for the purpose. Fasteners shall be hard aluminum or stainless steel.

2.1.1    Finishes

Finish shall be color anodized. Color anodized finish shall be AA-M10C22A42 in accordance with the requirements of AA DAF-45.

### 2.1.2 Welding and Fastening

Where possible, welds shall be located on unexposed surfaces. Welds required on exposed surfaces shall be smoothly dressed. Welding shall produce a uniform texture and color in the finished work, free of flux and spatter. Exposed screws or bolts will be permitted only at inconspicuous locations and shall have heads countersunk.

### 2.1.3 Anchors

Anchors shall be stainless steel or steel with a hot-dipped galvanized finish. Anchors of the sizes and shapes required shall be provided for securing aluminum frames to adjacent construction. Anchors shall be placed near top and bottom of each jamb and at intermediate points not more than 625 mm apart. Transom bars shall be anchored at ends, and mullions shall be anchored at head and sill. The bottom of each frame shall be anchored to the rough floor construction with 2.4 mm (3/32 inch) thick stainless steel angle clips secured to the back of each jamb and to floor construction. Stainless steel bolts and expansion rivets shall be used for fastening clip anchors. Door frames free of window wall system shall be reinforced and securely anchored to floor construction.

### 2.1.4 Hardware

Hardware for aluminum doors is specified in Section 08700 BUILDERS' HARDWARE. Doors and frames shall be cut, reinforced, drilled, and tapped at the factory to receive template hardware. Reinforcement shall be provided in the core of doors as required to receive locks, door closers, and other hardware. Doors to receive surface applied hardware shall be reinforced as required.

### 2.1.5 Glazing

Glazing shall be as specified in Section 08810 GLASS AND GLAZING. Metal glazing beads, vinyl inserts, and glazing gaskets shall be provided for securing glass. Glass stops shall be tamperproof on exterior side.

### 2.1.6 Weatherstripping

Weatherstripping shall be continuous silicone-treated wool pile type, or a type recommended by the door manufacturer and shall be provided on head and jamb of exterior door frames. Weatherstripping for bottom of doors shall be as shown. Weatherstripping shall be easily replaced without special tools, and shall be adjustable at meeting stiles of pairs of doors. Air leakage rate of weatherstripping shall not exceed 0.775 L/s per lineal meter (0.5 cfm per lineal foot) of crack when tested in accordance with ASTM E 283 at standard test conditions.

## 2.2 ALUMINUM FRAMES

Frames shall be double-glazed window wall system and shall have a minimum condensation resistance factor of 67 in accordance with AAMA 1503.1. Frames shall be fabricated of extruded aluminum shapes to contours as shown on the drawings. Shapes shown are representations of design, function, and

required profile. Dimensions shown are minimum. Shapes of equivalent design may be submitted, subject to approval of samples. Minimum metal wall thickness shall be 2.29 mm, except glazing beads, moldings, and trim shall be not less than 1.27 mm. Frames that are to receive glass shall have removable snap-on glass stops and glazing beads. Joints in frame members shall be milled to a hairline tight fit so that raw edges of the assembly are not visible, sealed internally to prevent water infiltration, reinforced, and secured mechanically by appropriate screws or by screw spline attachment.

## 2.3 ALUMINUM DOORS

Doors shall be not less than 44.4 mm (1-3/4 inches) thick. Clearances at hinge stiles, lock stiles and top rails, floors and thresholds, shall comply with manufacturer's standard. Single-acting doors shall be beveled 3 mm at lock and meeting stile edges. Double-acting doors shall have rounded edges at hinge stile, lock stile, and meeting stile edges.

### 2.3.1 Full-Glazed Stile and Rail Doors

Doors shall have wide stiles and rails as shown, and shall be fabricated from extruded aluminum hollow seamless tubes or from a combination of open-shaped members interlocked or welded together. Doors shall be single-glazed. Top and bottom rail shall be fastened together by means of welding or by 10 mm diameter plated tensioned steel tie rods. An adjustable mechanism shall be provided in the top rail of narrow stile doors to allow for minor clearance adjustments after installation. Extruded aluminum snap-in glazing beads shall be provided on interior side of doors. Extruded aluminum theft-proof snap-in glazing beads or fixed glazing beads shall be provided on exterior or security side of doors. Glazing beads shall have vinyl insert glazing gaskets, designed to receive glass of thickness required. Glass is specified in Section 08810 GLASS AND GLAZING.

## 2.4 COLOR, TEXTURE, AND PATTERN

Color, Texture, and pattern shall be in accordance with COLOR SCHEDULE

## PART 3 EXECUTION

### 3.1 INSTALLATION OF DOORS, FRAMES, AND ACCESSORIES

#### 3.1.1 Protection of Aluminum

Aluminum shall not be used where it will be in contact with copper or where it will contact water which flows over copper surfaces. Aluminum that will be in contact with wet or pressure-treated wood, mortar, concrete, masonry, or ferrous metals shall be protected against galvanic or corrosive action by one of the following methods.

##### 3.1.1.1 Paint

Aluminum surfaces to be protected shall be solvent cleaned and given a coat of zinc-molybdate primer and one coat of aluminum paint.

#### 3.1.1.2 Nonabsorptive Tape or Gasket

Nonabsorptive tape or gasket shall be placed between the adjoining surfaces and shall be cemented to the aluminum surface using a cement compatible with aluminum.

#### 3.1.2 Installation

Frames and framing members shall be accurately set in position to receive adjoining components. Frames shall be plumb, square, level, and in alignment, and securely anchored to adjacent construction. Metal-to-metal joints between framing members and joints between framing members and building surfaces shall be sealed as specified in Section 07900 JOINT SEALING. Doors shall be accurately hung with proper clearances, and adjusted to operate properly.

#### 3.1.3 Cleaning

Doors and frames shall be cleaned in accordance with the manufacturer's approved instructions.

-- End of Section --

## SECTION 08210

WOOD DOORS  
05/97

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN HARDBOARD ASSOCIATION (AHA)

AHA 135.4 (1995) Basic Hardboard

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 283 (1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

## ARCHITECTURAL WOODWORK INSTITUTE (AWI)

AWI-QS (1997) Architectural Woodwork Quality Standards, and Quality Certification Program

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3 (1991) High-Pressure Decorative Laminates

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80 (1995) Fire Doors and Windows

NFPA 101 (1997) Safety to Life from Fire in Buildings and Structures

NFPA 252 (1995) Fire Tests of Door Assemblies

## NATIONAL WOOD WINDOW &amp; DOOR ASSOCIATION (NWWDA)

NWWDA I.S. 1-A (1993) Architectural Wood Flush Doors

NWWDA I.S. 4 (1994) Water-Repellent Preservative Non-Pressure Treatment for Millwork

## 1.2 GENERAL REQUIREMENTS



### 1.2.1 Standard Products

Doors shall be of the type, size, and design indicated on the drawings, and shall be the standard products of manufacturers regularly engaged in the manufacture of wood doors.

### 1.2.2 Marking

Each door shall bear a stamp, brand, or other identifying mark indicating quality and construction of the door. The identifying mark or a separate certification shall include identification of the standard on which construction of the door is based, identity of the manufacturing plant, identification of the standard under which preservative treatment, if used, was made, and identification of the doors having a Type I glue bond.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-02 Shop Drawings

Wood Doors and Frames; GA-BK, GA-CH, GA-DN, GA-HQ.

Drawings indicating the location of each door, elevation of each type of door, details of construction, marks to be used to identify the doors, and location and extent of hardware blocking. Drawings shall include catalog cuts or descriptive data for doors, weatherstripping, flashing, and thresholds to be used.

#### Fire Doors

Manufacturers preprinted installation and touch-up instructions.

#### SD-04 Samples

Factory Coated Natural Finish; GA-BK, GA-DN, GA-HQ.

Samples of factory applied natural finish.

#### SD-07 Certificates

#### Fire Rated Doors Adhesives

Certificates for oversize fire doors and/or door/frame assemblies stating

that the doors are identical in design, materials, and construction to a door that has been tested and meets the requirements for the class indicated. Certificate stating that adhesives used for proposed doors do not contain any formaldehyde.

#### 1.4 STORAGE

Doors shall be stored in fully covered areas and protected from damage and from extremes in temperature and humidity. Doors shall be stored on supports to prevent warping or twisting, and to provide ventilation. Factory cartons or wrappers shall be kept intact until installation.

#### 1.5 HARDWARE

Hardware, including weatherstripping and thresholds, is specified in Section 08700 BUILDERS' HARDWARE.

#### 1.6 GLAZING

Glazing is specified in Section 08810 GLASS AND GLAZING.

#### 1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

### PART 2 PRODUCTS

#### 2.1 GENERAL FABRICATION REQUIREMENTS

##### 2.1.1 Edge Sealing

Wood end-grain exposed at edges of doors shall be sealed prior to shipment.

##### 2.1.2 Adhesives

Adhesives shall be in accordance with NWWDA I.S. 1-A, requirements for Type II Bond Doors (water-repellent) for interior doors. Adhesive for doors to receive a transparent finish shall be nonstaining. Adhesives shall contain no formaldehydes.

##### 2.1.3 Prefitting

Doors shall be furnished prefitted or unfitted at the option of the Contractor.

#### 2.2 FLUSH DOORS

Flush doors shall be solid core and shall conform to NWWDA I.S. 1-A, except for the one year acclimatization requirement in paragraph T-2, which shall not apply. Wood doors shall be 5-ply construction with faces, stiles, and rails bonded to the cores.

##### 2.2.1 Core Construction

#### 2.2.1.1 Solid Cores

Door construction shall be particle board core mineral core with vertical and horizontal edges bonded to the core. Blocking and hardware reinforcements for particle board and mineral core doors shall be blocking option HB-1-5 in accordance with NWWDA I.S. 1-A.

#### 2.2.2 Face Panels

##### 2.2.2.1 Transparent Stained Wood Veneer Doors

Veneer doors to receive a transparent stained natural finish and shall be Premium Grade, rift cut sawn red oak veneer rift cut in accordance with NWWDA I.S. 1-A. Vertical stile strips shall be selected to provide edges of the same species and/or color as the face veneer. Door finish shall be in accordance with paragraph FINISHING.

#### 2.3 FIRE RATED DOORS

Fire rated door assemblies shall bear the listing identification label of a nationally recognized testing laboratory qualified to perform tests of fire door assemblies in accordance with NFPA 252 and having a listing for the tested assemblies. The specific time interval rating on the labels shall be as shown. Door assemblies shall be in accordance with NFPA 80. Listing identification on labels shall be constructed and permanently applied by a method which results in their destruction should they be removed. Fire rated doors shall be mineral core 60.

##### 2.3.1 Reinforcement Blocking

Fire rated doors shall be provided, as required, with hardware reinforcement blocking, and top, bottom, and intermediate rail blocking. Lock blocks shall be manufacturer's standard. Reinforcement blocking shall be in compliance with the manufacturer's labeling requirements. Reinforcement blocking shall not be of mineral material.

##### 2.3.2 Stile Edges

Composite fire rated doors shall be provided with vertical stile edges that do not contain fire retardant salts. Vertical stiles shall be of the same species and/or color as the face veneer.

#### 2.4 MOULDING AND EDGING

Moulding and edging shall be as shown. Wood species for transparent finished doors shall be compatible with veneer.

#### 2.5 INSERT LOUVERS

Where indicated, doors shall be provided with sightproof insert louvers. Louvers shall be stationary or adjustable as shown. Blades shall be welded or tenoned to the frame and the entire assembly fastened to the door with metal or wood moldings on both sides as shown. The frame shall be

nonremovable from the outside of the door.

## 2.6 FINISHING

### 2.6.1 Factory Coated Natural Finish

Doors indicated to receive factory coated natural finish shall be given a transparent finish conforming to AWI-QS, Section 1500, Custom Grade, dark medium stain, medium rubbed sheen, close grain effect. Finish shall be AWI factory finish system Number TR3 or TR4. Color of the natural finish shall be in accordance with Finish Schedule for each building. Edges of unfitted doors shall be field finished after fitting to the frames. Standard pre-mixed stain colors shall not limit the ability to match the stain color required. Custom mixing shall be used where necessary to achieve the desired color an results.

## PART 3 EXECUTION

### 3.1 INSTALLATION OF DOORS

#### 3.1.1 General Use Doors

Doors shall be fit, hung, and trimmed as required. Door shall have a clearance of 3 mm at the sides and top and shall have a bottom clearance of 6 mm over thresholds and 13 mm at other locations unless otherwise shown. The lock edge or both edges of doors shall be beveled at the rate of 3 mm in 50 mm. Cuts made on the job shall be sealed immediately after cutting, using a clear varnish or sealer. Bottom of doors shall be undercut to allow clear door swing over carpeted areas. Vertical edges of doors which have not been rounded or beveled at the factory shall be eased when the doors are installed.

#### 3.1.2 Fire Doors

Installation, hardware, and operational characteristics shall conform to NFPA 80 and NFPA 101 and shall be in strict conformance with the manufacturer's printed instructions. Properly sized pilot holes shall be drilled for screws in door edges. Factory applied labels shall remain intact where installed. Labeled hinge stile edge and top edge of door shall not be trimmed. Lockstile edge and bottom edge may be trimmed only to the extent recommended by the door manufacturer.

-- End of Section --

## SECTION 08330

OVERHEAD ROLLING DOORS  
**06/97**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 653/A 653M	(1996) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip process
ASTM E 84	(1996a) Surface Burning Characteristics of Building Materials
ASTM E 330	(1990) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

## AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE Fundament HDBK-IP	(1997) Handbook, Fundamentals I-P Edition
ASHRAE Fundament HDBK-SI	(1997) Handbook, Fundamentals SI Edition

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(1993) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated Not More Than 2,000 Volts AC or 750 Volts DC
NEMA ICS 6	(1993) Industrial Control and Systems Enclosures
NEMA MG 1	(1993; Rev 1, Rev 2, Rev 3) Motors and Generators

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(1996; Errata 96-4) National Electrical Code
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NFPA 80

(1995) Fire Doors and Fire Windows

## 1.2 DESCRIPTION

Overhead rolling doors shall be spring counterbalanced, rolling type, with interlocking slats, complete with guides, fastenings, hood, brackets, and operating mechanisms, and shall be designed for use on openings as indicated. Each door shall be provided with a permanent label showing the manufacturer's name and address and the model/serial number of the door.

### 1.2.1 Wind Load Requirements

Doors and components shall be designed to withstand the minimum design wind load of 960 pa. Doors shall be constructed to sustain a superimposed load, both inward and outward, equal to 1-1/2 times the minimum design wind load. The door shall support the superimposed loads for a minimum period of 10 seconds without evidence of serious damage and shall be operable after conclusion of the tests. Calculations shall be provided that prove the door design meets the design windload requirements. Test data showing compliance with design windload requirements for the specific door design tested in accordance with the uniform static air pressure difference test procedures of ASTM E 330 shall be provided. Test data showing compliance with design windload requirements for the door design tested in accordance with a uniform static load equal to 1-1/2 times the minimum design windload, shall be provided. The uniform static load test specimen shall be supported using guides, endlocks, and windlocks as required for project installation. Recovery shall be at least 3/4 of the maximum deflection within 24 hours after the test load is removed.

### 1.2.2 Operational Cycle Life

All portions of the door and door operating mechanism that are subject to movement, wear, or stress fatigue shall be designed to operate through a minimum number of 10 cycles per day. One complete cycle of door operation is defined as when the door is in the closed position, moves to the full open position, and returns to the closed position.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

SD-02 Shop Drawings

Overhead Rolling Door Unit; GA-SAB, GA-CH.

Drawings showing the location of each door including schedules. Drawings shall include elevations of each door type, details and method of anchorage, details of construction, location and installation of hardware, shape and thickness of materials, details of joints and connections, and details of guides, power operators, controls, and other fittings.

#### SD-03 Product Data

Overhead Rolling Door Unit; GA-SAB, GA-CH.

Manufacturer's catalog data, test data, and summary of forces and loads on the walls/jambs.

#### SD-04 Samples

Overhead Rolling Door Unit; GA-SAB, GA-CH.

Manufacturer's standard color samples of factory applied finishes.

#### SD-06 Test Reports

Tests

Written record of fire door drop test.

#### SD-08 Manufacturer's Instructions

Overhead Rolling Door Unit

Manufacturer's preprinted installation instructions.

#### SD-10 Operation and Maintenance Data

Operation Manual

Maintenance and Repair Manual

Six copies of the system operation manual and system maintenance and repair manual for each type of door and control system.

### 1.4 DELIVERY AND STORAGE

Doors shall be delivered to the jobsite wrapped in a protective covering with the brands and names clearly marked thereon. Doors shall be stored in a dry location that is adequately ventilated and free from dirt and dust, water, and other contaminants, and in a manner that permits easy access for inspection and handling.

### 1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period shall be provided.

## 1.6 OPERATION AND MAINTENANCE MANUALS

Operating instructions outlining the step-by-step procedures required for motorized door and shutter operation for the overhead rolling door unit shall be provided. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, troubleshooting guides, and simplified diagrams for the equipment as installed shall be provided. A complete list of parts and supplies, source of supply, and a list of the high mortality maintenance parts shall be provided.

## PART 2 PRODUCTS

### 2.1 OVERHEAD ROLLING DOORS

Doors shall be surface-mounted type with guides at jambs set back a sufficient distance to clear the opening. Exterior doors shall be mounted on interior side of walls.

#### 2.1.1 Curtains

The curtains shall roll up on a barrel supported at the head of opening on brackets, and shall be balanced by helical torsion springs. Steel slats for doors less than 4.5 m wide shall be minimum bare metal thickness of 0.85 mm. Slats shall be of the minimum bare metal decimal thickness required for the width indicated and the wind pressure specified above. Slats for fire doors over 3.6 m wide and under 6 m wide shall be not less than 1.0 mm steel.

##### 2.1.1.1 Insulated Curtains

The slat system shall supply a minimum R-value of 7 when calculated in accordance with ASHRAE Fundament HDBK-IP ASHRAE Fundament HDBK-SI. Slats shall be of the flat type as standard with the manufacturer. Slats shall consist of a urethane core not less than 17 mm thick, completely enclosed within metal facings. Exterior face of slats shall be gauge as specified for curtains. Interior face shall be not lighter than 0.70 mm. The insulated slat assembly shall have a flame spread rating of not more than 25 and a smoke development factor of not more than 50 when tested in accordance with ASTM E 84.

#### 2.1.2 Endlocks and Windlocks

The ends of each alternate slat for interior doors shall have steel iron endlocks of manufacturer's stock design. In addition to endlocks, non-rated exterior doors shall have the manufacturer's standard windlocks as required to withstand the wind load. Windlocks shall prevent the curtain from leaving guides because of deflection from specified wind pressure.

#### 2.1.3 Bottom Bar

The curtain shall have a off-set bottom bar consisting of two hot-dip



galvanized steel angles for steel doors. A sensing edge shall be attached to the bottom bar of doors that are electric-power operated.

#### 2.1.4 Guides

Guides shall be steel structural shapes or formed steel shapes, of a size and depth to provide proper clearance for operation and resistance under the design windload. Guides shall be attached to adjoining construction with fasteners recommended by the manufacturer. Spacing of fasteners shall be as required to meet the minimum design windload. Doors and guides in hazardous areas shall have static grounding.

#### 2.1.5 Barrel

The barrel shall be steel pipe or commercial welded steel tubing of proper diameter for the size of curtain. Deflection shall not exceed 2.5 mm per meter of span. Ends of the barrel shall be closed with metal plugs, machined to fit the pipe. Aluminum plugs are acceptable on non-fire door barrels.

#### 2.1.6 Springs

Oil tempered helical steel counter-balance torsion springs shall be installed within the barrel and shall be capable of producing sufficient torque to assure easy operation of the door curtain. Access shall be provided for spring tension adjustment from outside of the bracket without removing the hood.

#### 2.1.7 Brackets

Brackets shall be of steel plates to close the ends of the roller-shaft housing, and to provide mounting surfaces for the hood. An operation bracket hub and shaft plugs shall have sealed prelubricated ball bearings.

#### 2.1.8 Hoods

Hoods shall be steel with minimum bare metal thickness of 0.70 mm formed to fit contour of the end brackets, and shall be reinforced with steel rods, rolled beads, or flanges at top and bottom edges. Multiple segment and single piece hoods shall be provided with support brackets of the manufacturer's standard design as required for adequate support.

#### 2.1.9 Weatherstripping

Exterior doors shall be fully weatherstripped. A compressible and replaceable weather seal shall be attached to the bottom bar. Weather seal at door guides shall be continuous vinyl or neoprene, bulb or leaf type, or shall be nylon-brush type. A weather baffle shall be provided at the lintel or inside the hood. Weatherstripping shall be easily replaced without special tools.

#### 2.1.10 Operation

Doors shall be operated by means of electric power with auxiliary chain hoist.

Equipment shall be designed and manufactured for usage in non-hazardous and hazardous Class 1-A, Division S, and Group 3 areas.

#### 2.1.10.1 Electric Power Operator With Auxiliary Chain Hoist Operation

Electric power operators shall be heavy-duty industrial type. The unit shall operate the door through the operational cycle life specified. The electric power operator shall be complete with electric motor, auxiliary operation, self-locking worm gear in oil bath for heavy-duty doors, brake, mounting brackets, push button controls, limit switches, magnetic reversing starter, and all other accessories necessary to operate components specified in other paragraphs of this section. The operator shall be so designed that the motor may be removed without disturbing the limit-switches settings and without affecting the emergency chain operator. Doors shall be provided with an auxiliary operator for immediate emergency manual operation of the door in case of electrical failure. Auxiliary operation shall be by means of galvanized in chiller plant and bronze in Lawn Maintenance, endless chain extending to within 900 mm of the floor. The emergency manual operating mechanism shall be so arranged that it may be operated from the floor without affecting the settings of the limit switches. A mechanical device shall be included that will disconnect the motor from the drive operating mechanism when the auxiliary operator is used. Where control voltages differ from motor voltage, a control voltage transformer shall be provided in and as part of the electric power operator system. Control voltage shall not exceed 120 volts.

- a. Motors: Drive motors shall conform to NEMA MG 1, shall be high-starting torque, reversible type, and shall be of sufficient wattage and torque output to move the door in either direction from any position at a speed range of 0.23 m per second (6 to 8 inches per second) without exceeding the rated capacity. Motors shall be suitable for operation on 460 volts, 60 hertz, 3- phase current and shall be suitable for across-the-line starting. Motors shall be designed to operate at full capacity over a supply voltage variation of plus or minus 10 percent of the motor voltage rating. Motors shall be provided with overload protection.
- b. Controls: Control equipment shall conform to NEMA ICS 2. Enclosures shall conform to NEMA ICS 6, Type 12 (industrial use), Type 7 or 9 in hazardous locations, in accordance with NFPA 70. Each control station shall be of the three position button type, marked "OPEN," "CLOSE," and "STOP." The "OPEN" and "STOP" controls shall be of the momentary contact type with seal-in contact. The "CLOSE" control shall be of the constant pressure type. When the door is in motion and the "STOP" control is pressed, the door shall stop instantly and remain in the stop position; from the stop position, the door shall be operable in either direction by the "OPEN" or "CLOSE" controls. Controls shall be of the full-guarded type to prevent accidental operation. Readily adjustable limit switches shall be provided to automatically stop the doors at their fully open and closed positions.
- c. Sensing Edge Device: The bottom edge of electric power operated doors shall have an electric and a pneumatic sensing edge for

hazardous and non-hazardous areas that will reverse the door movement upon contact with an obstruction and cause the door to return to its full open position. The sensing edge shall not substitute for a limit switch. Exterior doors shall be provided with a combination compressible weather seal and sensing edge.

- d. Electrical Work: Conduit and wiring necessary for proper operation shall be provided under Section 16415 ELECTRICAL WORK, INTERIOR. Flexible connections between doors and fixed supports shall be made with flexible type SJO cable, except in hazardous locations where wiring shall conform to NFPA 70, as appropriate. The cable shall have a spring-loaded automatic take up reel or a coil cord equivalent device.

#### 2.1.11 Inertia Brake

Overhead rolling door shall have a mechanical inertia brake device which will stop the door from free fall in any position, should there be a failure in the motor operator brake or roller chain drive. The unit shall be capable of being reset with a back drive action.

#### 2.1.12 Locking

Locking for motor operated doors shall consist of self-locking gearing with chain lock for emergency hand chain.

#### 2.1.13 Finish

Steel slats and hoods shall be hot-dip galvanized, G60 in accordance with ASTM A 653/A 653M, and shall be treated for paint adhesion and shall receive a factory baked-on finish coat. The paint system shall withstand a minimum of 1500 hours without blistering, bubbling, or rust. Surfaces other than slats, hood, and faying surfaces shall be cleaned and treated to assure maximum paint adherence and shall be given a factory dip or spray coat of rust inhibitive metallic oxide or synthetic resin primer. Color shall be in accordance with FINISH SCHEDULE.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

Doors shall be installed in accordance with approved detail drawings and manufacturer's instructions. Anchors and inserts for guides, brackets, motors, switches, hardware, and other accessories shall be accurately located. Upon completion, doors shall be free from warp, twist, or distortion. Doors shall be lubricated, properly adjusted, and demonstrated to operate freely.

-- End of Section --

## SECTION 08331

METAL ROLLING COUNTER DOORS  
09/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 240/A 240M	(1999b) Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels
ASTM A 653/A 653M	(1999a) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 209M	(1995) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 221	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 221M	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(1999) Fire Doors and Fire Windows
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## 1.2 GENERAL

Rolling counter doors shall be of the type, size, and design indicated on the drawings, and shall be the standard product of a manufacturer regularly engaged in the production of rolling counter doors. Each door shall be provided with a permanent label showing the manufacturer's name and address and the model number of the door.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items

designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-02 Shop Drawings

##### Approved Detail Drawings; GA-HQ

Drawings showing elevations of each door type, details of anchorage, details of construction, location and description of hardware, shape and thickness of materials, details of joints and connections, and details of guides and fittings. A schedule showing the location of each counter door shall be included with the drawings.

#### SD-03 Product Data

##### Rolling Counter Doors

Manufacturer's descriptive data and catalog cuts.

Installation

Cleaning

Manufacturer's preprinted installation and cleaning instructions.

#### SD-10 Operation and Maintenance Data

##### Operation

Six complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, troubleshooting guides, and simplified diagrams for the equipment as installed. Spare parts data for each different item of material and equipment specified shall be supplied not later than 15 days prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 1 year and 3 years of service.

### 1.4 DELIVERY AND STORAGE

Rolling counter doors shall be delivered to the jobsite wrapped in a protective covering with the brands and names clearly marked thereon. Rolling counter doors shall be stored in accordance with the manufacturer's instructions in a dry location that is adequately ventilated and free from dust, water, or other contaminants, and in a manner that permits easy access for inspecting and handling. Doors shall be handled carefully to prevent damage. Damaged items that cannot be restored to like-new condition shall

be replaced.

## 1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

## PART 2 PRODUCTS

### 2.1 BASIC COMPONENTS

#### 2.1.1 Curtain

The curtain shall be fabricated of extruded aluminum slats conforming to ASTM B 221M, Alloy 6063, as specified. Thickness of slat material shall be as required by width of opening or as required by specified fire-rating. Slats shall be approximately 32 to 38 mm wide with a depth of crown of 13 mm.

Alternate slats shall be fitted with end locks to maintain curtain alignment. Bottom of curtain shall be provided with angle or tubular bar reinforcement matching the curtain, and fitted with a resilient bottom seal.

#### 2.1.2 Jamb Guides

Guides shall be of 3 mm minimum thickness extruded aluminum conforming to ASTM B 221M , Alloy 6063, and shall be fitted with neoprene silencers or replaceable heavy nap striping to eliminate noise and dust infiltration.

#### 2.1.3 Counterbalance Shaft Assembly

The curtain shall be coiled around a steel tube of sufficient thickness and diameter to prevent deflection exceeding 2.5 mm per meter. The barrel shall contain oil tempered helical steel torsion springs capable of sufficient torque to counterbalance the weight of the curtain. Springs shall be calculated to provide a minimum of 7,500 operating cycles (one complete cycle of door operation will begin with the door in the closed position, move to the full open position and return to the closed position).

#### 2.1.4 Brackets

Brackets shall be a minimum 12 gauge thickness steel if flat plate, or 16 gauge thickness if there are a minimum of 3 returns of 19 mm width.

#### 2.1.5 Hood

The hood shall be of 1.02 mm minimum thickness aluminum sheet conforming to ASTM B 209M , Alloy 5005.

#### 2.1.6 Locks

The curtain shall be locked at each side of the bottom bar by an integral slide bolt suitable for padlocks by others. Lock shall be on the secure room side of the counter door.

### 2.2 ROLLING COUNTER DOOR (NON-RATED)

Rolling counter doors shall conform to the requirements specified herein and shall be constructed of aluminum curtains, guides and hood components.

## 2.3 OPERATION

### 2.3.1 Manual Operation

The curtain shall be operated by means of manual push-up with lift handles or continuous full width lift bar.

## 2.4 FINISH

Exposed parts of the counter door, including the curtain, bottom rail, guides, and hood shall be of uniform finish and appearance. Aluminum shall have a brushed clear anodized finish.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Doors shall be installed in accordance with approved detail drawings and manufacturer's instructions. Anchors and inserts for guides, brackets, hardware, and other accessories shall be accurately located. Upon completion, doors shall be free from warp, twist, or distortion. Doors shall be lubricated, properly adjusted, and demonstrated to operate freely.

### 3.2 CLEANING

Aluminum doors shall be cleaned in accordance with manufacturer's approved instructions.

-- End of Section --

## SECTION 08353

## ACCORDION PARTITIONS

05/95

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84	(1996a) Surface Burning Characteristics of Building Materials
ASTM E 90	(1996) Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions
ASTM E 413	(1987; R 1994) Rating Sound Insulation
ASTM F 793	(1993) Standard Classification of Wallcovering by Durability Characteristics

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA LD 3	(1995) High-Pressure Decorative Laminates
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## UNDERWRITERS LABORATORIES (UL)

UL 10B	(1997) Fire Tests of Door Assemblies
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

SD-02 Shop Drawings

Accordion Partitions; GA-BK.



Drawings shall show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work including clearances for maintenance and operation.

#### SD-03 Product Data

Accordion Partitions; GA-BK.

Manufacturer's descriptive data, performance charts, catalog cuts, and installation instructions.

#### SD-04 Samples

Accordion Partitions

Manufacturer's standard color samples of specified surfaces and finishes.

#### SD-07 Certificates

Accordion Partitions

Certificate attesting that the materials meet the requirements specified and that partitions have specified acoustical and flame retardant properties, as determined by test.

#### SD-10 Operation and Maintenance Data

Accordion Partitions

Six complete copies of operating instructions outlining the procedures required for partitions. The instructions shall include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and operating features. Data shall include a complete list of parts and supplies, with current unit prices and source of supply, and a list of the parts recommended by the manufacturer to be replaced after 3 years of service.

Six complete copies of maintenance instructions explaining routine maintenance procedures including inspection, adjustments, lubrication, and cleaning. The instructions shall list possible breakdown, methods of repair, and a troubleshooting guide.

### 1.3 DELIVERY AND STORAGE

Materials shall be delivered to the jobsite in the manufacturer's original, unopened packages and shall be stored with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

### 1.4 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1 year period shall be provided.

## PART 2 PRODUCTS

## 2.1 MATERIALS

Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of such products and shall essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening. Equipment shall be supported by a service organization that is, in the opinion of the Contracting Officer, reasonably convenient to the site. Door and partition finishes shall have a Class A rating when tested in accordance with ASTM E 84.

### 2.1.1 Vinyl Covering

The vinyl coated fabric shall conform to ASTM F 793, Category V, Type II (Medium duty). Covering shall have wood grain textured design.

### 2.1.2 Hardware

Accordion partitions shall be furnished with grip handles with latch only. An upper latch with extended pulls shall be provided on units over 2400 mm high. Hardware shall be anodized aluminum with a natural finish, chrome plated or brass plated metal, or painted finish.

### 2.1.3 Track

Track shall be surface mounted and shall be of extruded aluminum or enamel finish steel. Track shall be manufacturer's standard product designed for the weight of door or partition furnished. Track sections shall be provided in the maximum lengths practicable, not less than 1800 mm long except for narrow doors and at ends of runs where short length is required. Suitable joint devices such as interlocking keys shall be provided at each joint to provide permanent alignment of track.

## 2.2 ACCORDION PARTITIONS

Accordion partitions shall consist of top hung ball bearing carriers which support a system of hinged folding panels with a durable surface finish. Partitions shall have perimeter and jamb seals which shall provide the indicated STC rating. Ferrous metal parts shall be either cadmium plated or zinc coated and post shall have manufacturer's standard shop finish paint. Doors shall be manually operated. Door widths shall be as shown.

### 2.2.1 Pantograph Framework with Flexible Covering

Accordion partitions shall have a steel pantograph hinged framework and shall be non-STC rated. Intermediate pantographs shall be provided as required and door shall have a control device to prevent flattening of the folds when the panel is fully extended. The covering shall be vinyl coated fabric.

## 2.3 COLOR

Color shall be in accordance with COLOR SCHEDULE.

PART 3 EXECUTION

3.1 INSTALLATION

Installation shall be in accordance with the manufacturer's approved installation instructions.

-- End of Section --

## SECTION 08361

## SECTIONAL OVERHEAD DOORS

09/99

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 36/A 36M	(1997; Rev. A) Carbon Structural Steel
ASTM A 123/A 123M	(1997; Rev. A) Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A 227/A 227M	(1993) Steel Wire, Cold-Drawn for Mechanical Springs
ASTM A 229/A 229M	(1993) Steel Wire, Oil-Tempered for Mechanical Springs
ASTM A 653/A 653M	(1998) Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
ASTM B 209M	(1995) Aluminum and Aluminum-Alloy Sheet and Plate (Metric)
ASTM B 209	(1996) Aluminum and Aluminum-Alloy Sheet and Plate
ASTM B 221M	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B 221	(1996) Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM C 236	(1989; R 1993) Steady-State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box
ASTM E 330	(1997) Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

## NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS (NAAMM)

NAAMM MFM	(1988) Metal Finishes Manual
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## DOOR AND ACCESS SYSTEMS MANUFACTURERS ASSOCIATION (DASMA)

ANSI/NAGDM 102 (1988) Sectional Overhead Type Doors

## NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 1 (1993) Industrial Control and Systems

NEMA ICS 2 (1993) Industrial Control and Systems  
 Controllers, Contactors and Overload Relays,  
 Rated Not More Than 2000 Volts AC or 750  
 Volts DC

NEMA ICS 6 (1993) Industrial Control and Systems  
 Enclosures

NEMA MG 1 (1993; Rev. 1-4) Motors and Generators

NEMA ST 20 (1992) Dry-Type Transformers for General  
 Applications

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70 (1999) National Electrical Code

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

## SD-02 Shop Drawings

Sectional Overhead Doors; GA-CH

Show types, sizes, locations, metal gages including minimum metal decimal thickness, hardware provisions, installation details, and other details of construction.

## SD-03 Product Data

Doors

Electric operators

For electrically motor-operated doors, submit manufacturer's wiring diagrams for motor and controls.

SD-08 Manufacturer's Instructions

Doors

SD-10 Operation and Maintenance Data

Doors

Submit Data Package 2 in accordance with Section 01781N, "Operation and Maintenance Data."

1.3 DELIVERY, STORAGE, AND HANDLING

Protect doors and accessories from damage during delivery, storage, and handling. Clearly mark manufacturer's brand name. Store doors in dry locations with adequate ventilation, free from dust and water. Storage shall permit easy access for inspection and handling. Remove damaged items and provide new.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Hard-Drawn Springwire

ASTM A 227/A 227M.

2.1.2 Oil-Tempered Springwire

ASTM A 229/A 229M.

2.1.3 Steel Sheet

ASTM A 653/A 653M.

2.1.4 Steel Shapes

ASTM A 36/A 36M.

2.1.5 Aluminum Extrusions

ASTM B 221M, Alloy 6063-T5.

2.1.6 Aluminum Sheets and Strips

ASTM B 209M, alloy and temper best suited for the purpose.

2.2 DOORS

ANSI/NAGDM 102. Industrial doors. Metal doors shall be horizontal sections hinged together which operate in a system of tracks to completely close the

door opening in the closed position and make the full width and height of the door opening available for use in the open position. Provide a permanent label on the door indicating the name and address of the manufacturer. Doors shall be of the standard lift type designed to slide up and back into a horizontal overhead position and requiring a maximum of 400 mm of headroom for 50 mm tracks and 535 mm of headroom for 75 mm tracks vertical lift type designed. Doors shall be operated by lifting handles by hand chain with gear or sprocket reduction by electric power with auxiliary hand chain operation.

## 2.3 DESIGN REQUIREMENTS

ANSI/NAGDM 102 design wind load shall be as indicated for the building. Doors shall remain operable and undamaged after conclusion of tests conducted in accordance with ASTM E 330 using the design wind load.

## 2.4 FABRICATION

### 2.4.1 Steel Overhead Doors

Form door sections of hot-dipped galvanized steel not lighter than 1.5 mm thick with flush surface without ribs or grooves. Sections shall be not less than 50 mm in thickness. Meeting rails shall have interlocking joints to ensure a weathertight closure and alignment for full width of the door. Sections shall be of the height indicated or the manufacturer's standard, except the height of an intermediate section shall not exceed 600 mm thick. Bottom sections may be varied to suit door height, but shall not exceed 750 mm in height.

#### 2.4.1.1 Aluminum Sections

At the Contractor's option, door sections may be constructed of aluminum in lieu of steel. Aluminum sections shall, as a minimum, provide the same structural and thermal properties as specified for steel sections.

### 2.4.2 Aluminum Panel Overhead Doors

Door sections shall be of panel construction with extruded aluminum stiles and rails with aluminum panels. Stiles and rails shall have a minimum wall thickness of 1.5 mm. Meeting rails shall have interlocking joints to ensure a weathertight closure and alignment for full width of door. Sections shall be of the height indicated or the manufacturer's standard, but the height of an intermediate section shall not exceed 600 mm. Bottom sections may be varied to suit door height, but shall not exceed 750 mm in height.

### 2.4.3 Tracks

Provide galvanized steel tracks not lighter than 1.8 mm thick for 50 mm tracks and not lighter than 2.5 mm thick for 75 mm tracks. Provide vertical tracks with continuous steel angle not lighter than 2.1 mm thick for installation to walls. Incline vertical track through use of adjustable brackets to obtain a weathertight closure at jambs. Reinforce horizontal track with galvanized steel angle; support from track ceiling construction with galvanized steel angle and cross bracing to provide a rigid

installation.

#### 2.4.4 Hardware

Provide hinges, brackets, rollers, locking devices, and other hardware required for complete installation. Roller brackets and hinges shall be 14 gage galvanized steel. Rollers shall have ball bearings and case-hardened races. Provide reinforcing on doors where roller hinges are connected. Provide a positive locking device and cylinder lock with two keys on manually operated doors.

#### 2.4.5 Counterbalancing

Counterbalance doors with an oil-tempered, helical-wound torsional spring mounted on a steel shaft. Spring tension shall be adjustable; connect spring to doors with cable through cable drums. Cable safety factor shall be at least 7 to 1.

### 2.5 MANUAL OPERATORS

#### 2.5.1 Pushup Operators

Provide lifting handles on both sides of door. The force required to operate the door shall not exceed 11.25 kilograms. Provide pulldown straps or ropes at bottom of doors over 2130 mm high.

#### 2.5.2 Chain Hoist Operators

Provide a galvanized, endless chain operating over a sprocket. Extend chain to within 1200 mm of the floor and mount on inside of building. Obtain reduction by use of roller chain and sprocket drive or gearing. Provide chain cleat and pin for securing operator chain. Hoist shall allow for future installation of power operators. The force required to operate the door shall not exceed 15.75 kilograms.

### 2.6 WEATHER SEALS AND SAFETY DEVICE

Provide exterior doors with weatherproof joints between sections by means of tongue-and-groove joints, rabbetted joints, shiplap joints, or wool pile, vinyl or rubber weatherstripping; a rubber, wool pile, or vinyl, adjustable weatherstrip at the top and jambs; and a compressible neoprene, rubber, wool pile, or vinyl weather seal attached to the bottom of the door. On exterior doors that are electrically operated, the bottom seal shall be combination compressible weather seal and safety device for stopping and reversing door movement.

### 2.7 FINISHES

Concealed ferrous metal surfaces and tracks shall be hot-dip galvanized. Other ferrous metal surfaces, except rollers and lock components, shall be hot-dip galvanized and shop primed.

#### 2.7.1 Galvanized and Shop Primed



Surfaces specified shall have a zinc coating, a phosphate treatment, and a shop prime coat of rust-inhibitive paint. The galvanized coating shall conform to ASTM A 653/A 653M, coating designation Z180, for steel sheets, and ASTM A 123/A 123M for assembled steel products. The weight of coatings for assembled products shall be as designated in Table I of ASTM A 123/A 123M for the class of material to be coated. The prime coat shall be a type especially developed for materials treated by phosphates and adapted to application by dipping or spraying. Repair damaged zinc-coated surfaces with galvanizing repair paint and spot prime. At the Contractor's option, a two-part system including bonderizing, baked-on epoxy primer, and baked-on enamel topcoat may be applied in lieu of prime coat specified.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

NFPA 70. Install doors in accordance with approved shop drawings and manufacturer's instructions. Upon completion, doors shall be weathertight and free from warp, twist, or distortion. Lubricate and adjust doors to operate freely.

#### 3.2 ELECTRICAL WORK

NFPA 70. Conduit, wiring, and mounting of controls are specified in Section 16402N, "Interior Distribution System."

#### 3.3 TESTING

After installation is complete, operate doors to demonstrate installation and function of operators, safety features, and controls. Correct deficiencies.

-- End of Section --

## SECTION 08520

## ALUMINUM WINDOWS

03/00

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

## ALUMINUM ASSOCIATION (AA)

AA 45 (1993) Aluminum Finishes

## AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION (AAMA)

AAMA/NWWDA 101/I.S.2 (1997) Voluntary Specification for Aluminum, Vinyl (PVC), and Wood Windows and Glass Doors

AAMA 611 (1998) Voluntary Specification for Anodized Architectural Aluminum

AAMA 902 (1998) Sash Balances

AAMA 1302 (1976) Forced-Entry Resistant Aluminum Prime Windows

AAMA 1503.1 (1988) Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections

AAMA 2603 (1998) Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

AAMA 2604 (1998) Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels

AAMA 2605 (1998) Voluntary Specification, Performance Requirements and Test Procedures for Superior Performance Organic Coatings on Aluminum Extrusions and Panels

## 1.2 CERTIFICATION

Each prime window unit shall bear the AAMA Label warranting that the product complies with AAMA/NWWDA 101/I.S.2. Certified test reports attesting that

the prime window units meet the requirements of AAMA/NWDA 101/I.S.2, including test size, will be acceptable in lieu of product labeling.

### 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-02 Shop Drawings

Windows; GA-BK, GA-HQ

#### SD-03 Product Data

Windows; GA-HQ, GA-BK

Hardware; GA-HQ, GA-BK

Fasteners; GA-HQ, GA-HQ

#### SD-04 Samples

Finish Sample

Window Sample

#### SD-05 Design Data

Structural calculations for deflection; GA-HQ, GA-BK

#### SD-06 Test Reports

Minimum condensation resistance factor

### 1.4 QUALITY ASSURANCE

#### 1.4.1 Shop Drawing Requirements

Drawings shall indicate elevations of windows, full-size sections, thickness and gages of metal, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, method of glazing, mullion details, method and materials for weatherstripping, material and method of attaching subframes, stools, casings, sills, trim, installation details, and other related items.

#### 1.4.2 Sample Requirements

##### 1.4.2.1 Finish Sample Requirements

Submit color chart of standard factory color coatings when factory-finish color coating is to be provided.

##### 1.4.2.2 Window Sample Requirements

Submit one full-size corner of each window type proposed for use. Where weatherstripping is required, fit sample with such items that are to be used.

#### 1.4.3 Design Data Requirements

Submit calculations to substantiate compliance with deflection requirements. Calculations shall be provided by a Professional Engineer.

#### 1.4.4 Test Report Requirements

Submit test reports for each type of window attesting that identical windows have been tested and meet the requirements specified herein for conformance to AAMA/NWDA 101/I.S.2 including test size, and minimum condensation resistance factor (CRF).

### 1.5 DELIVERY AND STORAGE

Deliver windows to project site in an undamaged condition. Use care in handling and hoisting windows during transportation and at the jobsite. Store windows and components out of contact with the ground, under a weathertight covering, so as to prevent bending, warping, or otherwise damaging the windows. Damaged windows shall be repaired to an "as new" condition as approved. If windows can not be repaired, provide a new unit.

### 1.6 PROTECTION

Protect finished surfaces during shipping and handling using the manufacturer's standard method, except that no coatings or lacquers shall be applied to surfaces to which calking and glazing compounds must adhere.

## PART 2 PRODUCTS

### 2.1 WINDOWS

Prime windows shall comply with AAMA/NWDA 101/I.S.2 and the requirements specified herein. In addition to compliance with AAMA/NWDA 101/I.S.2, window framing members for each individual lite of glass shall not deflect to the extent that deflection perpendicular to the glass lite exceeds  $L/175$  of the glass edge length when subjected to uniform loads at specified design pressures. Structural calculations for deflection shall be provided to substantiate compliance with deflection requirements. Provide windows of types, performance classes, performance grades, combinations, and sizes indicated or specified. Design windows to accommodate hardware, glass, weatherstripping, screens, and accessories to be furnished. Each window shall be a complete factory assembled unit with or without glass installed.

Dimensions shown are minimum. Provide windows with insulating glass and thermal break necessary to achieve a minimum Condensation Resistance Factor (CRF) of when tested in accordance with AAMA 1503.1.

#### 2.1.1 Fixed Windows (F)

Type F-HC40 (Optional Performance Grade).

#### 2.1.2 Glass and Glazing

Materials are specified in Section 08810, "Glass and Glazing."

#### 2.1.3 Calking and Sealing

Are specified in Section 07920, "Caulking and Sealants."

#### 2.1.4 Weatherstripping

AAMA/NWWDA 101/I.S.2.

### 2.2 FABRICATION

Fabrication of window units shall comply with AAMA/NWWDA 101/I.S.2.

#### 2.2.1 Provisions for Glazing

Design windows and rabbets suitable for glass thickness shown or specified. Design sash for outsidedouble glazing and for securing glass withglazing channels, or glazing compound.

#### 2.2.2 Weatherstripping

Provide for all windows to ensure a weather-tight seal meeting the infiltration requirements specified in AAMA/NWWDA 101/I.S.2. Provide easily replaceable factory-applied weatherstripping. Use molded vinyl, molded or molded-expanded neoprene or molded or expanded Ethylene Propylene Diene Terpolymer (EPDM) weatherstripping for compression contact surfaces. Do not use neoprene or polyvinylchloride weatherstripping where they will be exposed to direct sunlight.

#### 2.2.3 Fasteners

Use fasteners as standard with the window manufacturer for windows, trim, and accessories. Self-tapping sheet-metal screws are not acceptable for material more than 2 mm thick.

#### 2.2.4 Drips and Weep Holes

Provide drips and weep holes as required to return water to the outside.

#### 2.2.5 Mullions and Transom Bars

Provide mullions between multiple window units which meet the design pressure of 1440 Pa. Provide mullions with a structural thermal break.

Secure mullions and transom bars to adjoining construction and window units in such a manner as to permit expansion and contraction and to form a weathertight joint. Provide mullion covers on the interior and exterior to completely close exposed joints and recesses between window units and to present a neat appearance.

#### 2.2.6 Accessories

Provide windows complete with necessary hardware, fastenings, clips, fins, anchors, glazing beads, and other appurtenances necessary for complete installation.

##### 2.2.6.1 Hardware

AAMA/NWDA 101/I.S.2. The item, type, and functional characteristics shall be the manufacturer's standard for the particular window type. Provide hardware of suitable design and of sufficient strength to perform the function for which it is used.

##### 2.2.6.2 Fasteners

Provide concealed anchors of the type recommended by the window manufacturer for the specific type of construction. Anchors and fasteners shall be compatible with the window and the adjoining construction. Provide a minimum of three anchors for each jamb located approximately 150 mm from each end and at midpoint.

#### 2.2.7 Finishes

Exposed aluminum surfaces shall be factory finished with an anodic coating. Color shall be as indicated in the Color Schedule. All windows for each building shall have the same finish.

##### 2.2.7.1 Anodic Coating

Clean exposed aluminum surfaces and provide an anodized finish conforming to AA 45 and AAMA 611. Finish shall be:

- a. Architectural Class I (0.0175 mm or thicker), designation AA-M10-C22 A42, integral color anodized.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

##### 3.1.1 Method of Installation

Install in accordance with the window manufacturer's printed instructions and details. Build in windows as the work progresses or install without forcing into prepared window openings. Set windows at proper elevation, location, and reveal; plumb, square, level, and in alignment; and brace, strut, and stay properly to prevent distortion and misalignment. Bed screws or bolts in sill members, joints at mullions, contacts of windows with sills, built-in fins, and subframes in mastic sealant of a type recommended

by the window manufacturer. Install windows in a manner that will prevent entrance of water and wind.

### 3.1.2 Dissimilar Materials

Where aluminum surfaces are in contact with, or fastened to masonry, concrete, wood, or dissimilar metals, except stainless steel or zinc, the aluminum surface shall be protected from dissimilar materials as recommended in the Appendix to AAMA/NWDA 101/I.S.2. Surfaces in contact with sealants after installation shall not be coated with any type of protective material.

### 3.1.3 Anchors and Fastenings

Make provision for securing units to each other, to masonry, and to other adjoining construction. Windows installed in masonry walls shall have head and jamb members designed to recess into masonry wall not less than 11 mm.

## 3.2 CLEANING

Clean interior and exterior surfaces of window units of mortar, paint spattering spots, and other foreign matter to present a neat appearance, to prevent fouling of weathering surfaces and weather-stripping. Replace all stained, discolored, or abraded windows that cannot be restored to their original condition with new windows.

## 3.3 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of inch-pound measurements, and not on metric measurement commonly agreed to by the manufacturers or other parties. The inch-pound and metric measurements are as follows:

<u>PRODUCT</u>	<u>INCH-POUN</u>	<u>METRIC</u>
Metal Casing	0.0625 inch	1.59 mm
Aluminum Tube	0.0625 inch	1.59 mm
(Diameter)	1 inch	25 mm

-- End of Section --

## SECTION 08700

## BUILDERS' HARDWARE

03/96

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 283	(1991) Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen
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ASTM F 883	(1990) Padlocks
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## BUILDERS HARDWARE MANUFACTURERS ASSOCIATION (BHMA)

BHMA-01	(Effective thru Jun 1998) Directory of Certified Locks & Latches
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BHMA-02	(Effective thru Jul 1997) Directory of Certified Door Closers
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BHMA-03	(Effective thru Jul 1997) Directory of Certified Exit Devices
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BHMA ANSI/BHMA A156.1	(1997) Butts and Hinges
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BHMA ANSI/BHMA A156.2	(1996) Bored and Preassembled Locks and Latches
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BHMA ANSI/BHMA A156.3	(1994) Exit Devices
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BHMA ANSI/BHMA A156.4	(1992) Door Controls - Closers
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BHMA ANSI/BHMA A156.5	(1992) Auxiliary Locks & Associated Products
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BHMA ANSI/BHMA A156.6	(1994) Architectural Door Trim
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BHMA ANSI/BHMA A156.7	(1988) Template Hinge Dimensions
-----------------------	----------------------------------

BHMA ANSI/BHMA A156.8	(1994) Door Controls - Overhead Stops and Holders
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BHMA ANSI/BHMA A156.13	(1994) Mortise Locks & Latches
BHMA ANSI/BHMA A156.15	(1995) Closer Holder Release Devices
BHMA ANSI/BHMA A156.16	(1989) Auxiliary Hardware
BHMA ANSI/BHMA A156.17	(1993) Self Closing Hinges & Pivots
BHMA ANSI/BHMA A156.18	(1993) Materials and Finishes
BHMA ANSI/BHMA A156.19	(1990) Power Assist and Low Energy Power Operated Doors
BHMA ANSI/BHMA A156.20	(1996) Strap and Tee Hinges and Hasps
BHMA ANSI/BHMA A156.21	(1996) Thresholds
BHMA ANSI/BHMA A156.23	(1992) Electromagnetic Locks
BHMA ANSI/BHMA A156.24	(1992) Delayed Egress Locks

## DOOR AND HARDWARE INSTITUTE (DHI)

DHI-03	(1989) Keying Systems and Nomenclature
DHI-04	(1976) Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames
DHI 05	(1990) Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames
DHI-A115.1G	(1994) Installation Guide for Doors and Hardware
DHI A115-W	(Varies) Wood Door Hardware Standards (Incl A115-W1 thru A115-W9)

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 80	(1995) Fire Doors and Fire Windows
NFPA 101	(1997; Errata 97-1) Life Safety Code
NFPA 105	(1993) Installation of Smoke-Control Door Assemblies

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package

shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-02 Shop Drawings

Hardware Devices; GA-BK, GA-CH, GA-DN, GA-HQ, GA-SAB

Detail drawings for hardware devices for computerized keying systems, magnetic cards, keyless push button access control systems, and other electrical hardware devices showing complete wiring and schematic diagrams and other details required to demonstrate proper function of units.

Hardware Schedule; GA-BK, GA-CH, GA-DN, GA-HQ, GA-SAB

Hardware schedule listing all items to be furnished. The schedule shall include for each item: the quantities; manufacturer's name and catalog numbers; the ANSI number specified, sizes; detail information or catalog cuts; finishes; door and frame size and materials; location and hardware set identification cross-references to drawings; corresponding reference standard type number or function number from manufacturer's catalog if not covered by ANSI or BHMA; and list of abbreviations and template numbers.

Keying Schedule; GA-BK, GA-CH, GA-DN, GA-HQ, GA-SAB

Keying schedule developed in accordance with DHI-03, after the keying meeting with the user.

#### SD-03 Product Data

Hardware and Accessories; GA-BK, GA-CH, GA-DN, GA-HQ, GA-SAB

Manufacturer's descriptive data, technical literature, catalog cuts, and installation instructions. Spare parts data for locksets, exit devices, closers, electric locks, electric strikes, electro-magnetic closer holder release devices, and electric exit devices, after approval of the detail drawings, and not later than 3 month(s) prior to the date of beneficial occupancy. The data shall include a complete list of parts and supplies, with current unit prices and source of supply.

#### SD-07 Certificates

Hardware and Accessories

The hardware manufacturer's certificates of compliance stating that the supplied material or hardware item meets specified requirements. Each certificate shall be signed by an official authorized to certify in behalf of the product manufacturer and shall identify quantity and date or dates of shipment or delivery to which the certificates apply. A statement that the proposed hardware items appear in BHMA-01, BHMA-02 and BHMA-03 directories of certified products may be submitted in lieu of certificates.

### 1.3 PREDELIVERY CONFERENCE

Upon approval of the Hardware Schedule, the construction Contractor shall arrange a conference with the hardware supplier, Contracting Officer and the using agency to determine keying system requirements. Location of the key control storage system, set-up and key identification labeling will also be determined.

### 1.4 DELIVERY, STORAGE, AND HANDLING

Hardware shall be delivered to the project site in the manufacturer's original packages. Each article of hardware shall be individually packaged in the manufacturer's standard commercial carton or container, and shall be properly marked or labeled to be readily identifiable with the approved hardware schedule. Each change key shall be tagged or otherwise identified with the door for which its cylinder is intended. Where double cylinder functions are used or where it is not obvious which is the key side of a door, appropriate instructions shall be included with the lock and on the hardware schedule. Manufacturer's printed installation instructions, fasteners, and special tools shall be included in each package.

### 1.5 SPECIAL TOOLS

Special tools, such as those supplied by the manufacturer, unique wrenches, and dogging keys, shall be provided as required to adjust hardware items.

### 1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

### 1.7 OPERATION AND MAINTENANCE MANUALS

Six complete copies of maintenance instructions listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides shall be provided. The instructions for electric locks, electric strikes, electro-magnetic closer holder release devices, and electric exit devices shall include simplified diagrams as installed.

## PART 2 PRODUCTS

### 2.1 GENERAL HARDWARE REQUIREMENTS

Hardware shall conform to the requirements specified herein and the HARDWARE SETS listing at the end of this section. Hardware set numbers correspond to the set numbers shown on the drawings.

### 2.2 TEMPLATES

Requirements for hardware to be mounted on metal doors or metal frames shall be coordinated between hardware manufacturer and door or frame manufacturer by use of templates and other information to establish location, reinforcement required, size of holes, and similar details. Templates of hinges shall conform to BHMA ANSI/BHMA A156.7.

## 2.3 HINGES

Hinges shall conform to BHMA ANSI/BHMA A156.1. Hinges used on metal doors and frames shall also conform to BHMA ANSI/BHMA A156.7. Except as otherwise specified, hinge sizes shall conform to the hinge manufacturer's printed recommendations.

### 2.3.1 Hinges for Reverse Bevel Doors with Locks

Hinges for reverse bevel doors with locks shall have pins that are made nonremovable by means such as a set screw in the barrel, or safety stud, when the door is in the closed position.

### 2.3.2 Pivot Hinges

Pivot hinges shall conform to BHMA ANSI/BHMA A156.4.

### 2.3.3 Spring Hinges

Spring hinges shall conform to BHMA ANSI/BHMA A156.17.

## 2.4 LOCKS AND LATCHES

To the maximum extent possible, locksets, latchsets and deadlocks, and all components thereof, including cylinders and removable cores, shall be the products of a single manufacturer. Lock fronts for double-acting doors shall be rounded. Strikes for wood frames and pairs of wood doors shall be furnished with wrought boxes.

### 2.4.1 Mortise Lock and Latchsets

Mortise lock, latchsets, and strikes shall be series 1000 and shall conform to BHMA ANSI/BHMA A156.13, operational Grade 1. Strikes for security doors shall be rectangular without curved lip. Mortise type locks and latches for doors 44 mm thick and over shall have adjustable bevel fronts or otherwise conform to the shape of the door. Mortise locks shall have armored fronts.

### 2.4.2 Auxiliary Locks and Associated Products

Bored and mortise dead locks and dead latches, narrow style dead locks and dead latches, rim latches, dead latches, and dead bolts, shall conform to BHMA ANSI/BHMA A156.5. Bolt and latch retraction shall be dead bolt style. Strike boxes shall be furnished with dead bolt and latch strikes for Grade 1.

### 2.4.3 Lock Cylinders (Mortise, Rim and Bored)

Lock cylinders shall comply with BHMA ANSI/BHMA A156.5. Lock cylinders shall be a Best 7 pin six. Cylinders shall have key removable type cores. A great grand master keying system shall be provided. Construction interchangeable cores shall be provided. Disassembly of knob or lockset shall not be required to remove core from lockset. All locksets, lockable exit devices, and padlocks shall accept same interchangeable cores.

#### 2.4.4 Padlocks

Padlocks shall conform to ASTM F 883. Straps, tee hinges, and hasps shall conform to BHMA ANSI/BHMA A156.20.

#### 2.4.5 Lock Trim

Lock trim shall be cast, forged, or heavy wrought construction of commercial plain design. In addition to meeting the test requirement of BHMA ANSI/BHMA A156.2 or BHMA ANSI/BHMA A156.13, lever handles, roses, and escutcheons shall be 1.27 mm thick, if unreinforced. If reinforced, the outer shell shall be 0.89 mm thick and the combined thickness shall be 1.78 mm except that knob shanks shall be 1.52 mm thick. Knob diameter shall be 54 to 57 mm. Lever handles shall be of plain design with ends returned to no more than 10 mm from the door face.

### 2.5 EXIT DEVICES AND EXIT DEVICE ACCESSORIES

Exit devices and exit device accessories shall conform to BHMA ANSI/BHMA A156.3, Grade 1.

#### 2.5.1 Exit Devices and Auxiliary Items

Trim shall be of wrought construction and commercial plain design with straight, beveled, or smoothly rounded sides, corners, and edges. Adjustable strikes shall be provided for rim type and vertical rod devices. Open back strikes shall be provided for pairs of doors with mortise and vertical rod devices; except open back strikes shall be used on labeled doors only where specifically provided for in the published listings. Touch bars shall be provided in lieu of conventional crossbars and arms. Escutcheons shall be provided not less than 175 by 55 mm. Escutcheons shall be cut to suit cylinders and operating trim.

#### 2.5.2 Removable Mullions

Removable mullions shall be Type 22 of the box type and shall be used only with those exit devices for which the mullions were manufactured. Mullions shall be furnished with mullion stabilizers of the same manufacturer.

#### 2.5.3 Automatic Flush Bolts

Automatic flush bolts shall be Type 25 in accordance with BHMA ANSI/BHMA A156.3, and shall be installed at the top and bottom of the inactive leaf of pairs of fire rated doors where specified in the hardware sets. Flush bolts shall be mortised in the strike edge of the door.

### 2.6 KEYING

Locks shall be keyed in sets or subsets as scheduled. Change keys for locks shall be stamped with change number and the inscription "U.S. Property - Do Not Duplicate." Keys shall be supplied as follows:

Locks:	3 change keys each lock.
Master keyed sets:	5 keys each set.

Grand master keys:	5 total, each building.
Control keys:	5 total, each building.
Construction keys:	5 total, each building.
Blank keys:	5 total, each building.

The keys shall be furnished to the Contracting Officer arranged in a container for key control system storage in sets or subsets as scheduled.

## 2.7 DOOR CLOSING DEVICES

Door closing devices shall conform to BHMA ANSI/BHMA A156.4, Grade 1. Closing devices shall be products of one manufacturer for each type specified. The opening resistance of closing devices shall not exceed 67 N applied at the latch stile or exceed 22 N where low opening resistance is scheduled.

### 2.7.1 Surface Type Closers

Surface type closers shall be Grade 1, Series C03000 with options PT-4H, Size 1 or 2 through Size 6, and PT-4D with back check position valve. Except as otherwise specified, sizes shall conform to the manufacturer's published recommendations. Closers for outswinging exterior doors shall be top jamb mounted. Closers for doors close to a wall shall be of narrow projection so as not to strike the wall at the 90-degree open position.

### 2.7.2 Floor Closers and Pivots

Floor closers shall be Grade 1 with internal dead stop for all exterior doors. Floor closers shall have cement boxes. Pivots used on doors with floor closers shall be of the same manufacturer as the floor closers. Floor plates are not required where thresholds cover the closer cement box. Floor closers shall have independent latch and sweep speed adjusting valves, backcheck, mechanical selective hold-open (except fire rated openings), and optional delayed action. Setting tools shall be furnished for use in installing floor closers. Electric pivots and floor closers shall comply with BHMA ANSI/BHMA A156.4 with modifications to ensure correct operation of electric hardware items.

## 2.8 DOOR CONTROLS - OVERHEAD HOLDERS

Door controls - overhead holders shall conform to BHMA ANSI/BHMA A156.8.

## 2.9 POWER ASSIST AND LOW ENERGY POWER OPERATORS

Power assist and low energy power operators shall conform to BHMA ANSI/BHMA A156.19 and shall be electrically operated.

## 2.10 ARCHITECTURAL DOOR TRIM

Architectural door trim shall conform to BHMA ANSI/BHMA A156.6.

### 2.10.1 Door Protection Plates

#### 2.10.1.1 Armor Plates

Armor plates shall be Type J101 stainless steel, 900 mm in height, and 50 mm less in width than the width of the door for single doors and 25 mm less for pairs of doors. Edges of metal plates shall be square beveled. Where the door has a louver panel, the armor plate shall be omitted if top of louver frame is more than 500 mm above the bottom of the door.

#### 2.10.1.2 Kick Plates

Kick plates shall be Type J102 stainless steel. Width of plates shall be 50 mm less than door width for single doors and 25 mm less for pairs of doors. Height shall be 250 mm, except where the bottom rail is less than 250 mm the plate shall extend to within 13 mm of the panel mold or glass bead. Edges of metal plates shall be beveled.

#### 2.10.2 Push Plates

##### 2.10.2.1 Combination Push-Pull Plates

Combination push-pull plates shall be Type J303, 1.27 mm thick minimum stainless steel beveled four edges.

##### 2.10.2.2 Flat Plates

Flat plates shall be Type J301 1.27 mm thick stainless steel, size 75 mm x 350 mm. Edges of metal plates shall be square beveled.

#### 2.10.3 Door Pulls and Push/Pull Units

##### 2.10.3.1 Door Pulls

Door pulls shall be Category J400 brass stainless steel of plain modern design. Pulls for hollow metal, mineral core wood or kalamein doors shall be Type J405 thru-bolted to Type J301 flat push plates.

#### 2.11 AUXILIARY HARDWARE

Auxiliary hardware, consisting of door holders, and door stops, shall conform to BHMA ANSI/BHMA A156.16. Lever extension flush bolts shall be Type L14081. Dust-proof strikes shall be Type L04011 for doors that are not fire rated. Dust-proof strikes shall be Type L04021 for fire rated doors. Other auxiliary hardware of the types listed below, shall conform to BHMA ANSI/BHMA A156.16.

#### 2.12 MISCELLANEOUS

##### 2.12.1 Automatic Door Bottoms

Automatic door bottoms shall be semi-mortised type with aluminum housing cover, anodized clear finish. Door bottom shall have a wool, felt, rubber, vinyl, or neoprene seal and shall be actuated by the opening and closing of the door. The door bottom shall exclude light when the door is in the closed position and shall inhibit the flow of air through the unit.

### 2.12.2 Metal Thresholds

Thresholds shall conform to BHMA ANSI/BHMA A156.21. Thresholds for exterior doors shall be extruded aluminum of the type indicated and shall provide proper clearance and an effective seal with specified weather stripping. Thresholds for use with floor closers shall conform to BHMA ANSI/BHMA A156.4.

Where required, thresholds shall be modified to receive projecting bolts of flush bolts and exit devices. Thresholds for doors accessible to the handicapped shall be beveled with slopes not exceeding 1:2 and with heights not exceeding 13 mm. Air leakage rate of weatherstripping shall not exceed 0.775 liters per second per lineal meter of crack when tested in accordance with ASTM E 283 at standard test conditions.

### 2.12.3 Rain Drips

Extruded aluminum, not less than 1.78 mm thick, clear anodized. Door sill rain drips shall be 38 mm to 44 mm high by 16 mm projection. Overhead rain drips shall be approximately 38 mm high by 63 mm projection and shall extend 50 mm on either side of the door opening width.

### 2.12.4 Aluminum Housed Type Weatherseals

Weatherseals of the type indicated shall consist of extruded aluminum retainers not less than 1.78 mm wall thickness with vinyl, neoprene, silicone rubber, polyurethane or vinyl brush inserts. Aluminum shall be clear (natural) anodized. Weatherseal material shall be of an industrial/commercial grade. Seals shall remain functional through all weather and temperature conditions. Air leakage rate of weatherstripping shall not exceed 0.775 liters per second per lineal meter of crack when tested in accordance with ASTM E 283 at standard test conditions.

### 2.12.5 Key Control Storage System

Key control storage system shall conform to BHMA ANSI/BHMA A156.5, Type E835, capacity 400, and shall be properly labeled for key identification. Set up, identification labeling and location of the key control storage shall be as directed at the Predelivery Conference.

### 2.12.6 Door Stops

Wall stops, floor stops and combination stop and holders shall conform to BHMA ANSI/BHMA A156.16.

## 2.13 FASTENINGS

Fastenings of proper type, size, quantity, and finish shall be supplied with each article of hardware. Machine screws and expansion shields shall be used for attaching hardware to concrete or masonry. Fastenings exposed to the weather in the finished work shall be of brass, bronze, or stainless steel. Sex bolts, through bolts, or machine screws and grommet nuts, where used on reverse-bevel exterior doors equipped with half-surface or full-surface hinges, shall employ one-way screws or other approved tamperproof screws. Screws for the jamb leaf of half-mortise and full-surface hinges attached to structural steel frames shall be one-way or



other approved tamperproof type.

## 2.14 FINISHES

Unless otherwise specified, finishes shall conform to those identified in BHMA ANSI/BHMA A156.18. Locks, latches, and exit devices shall be stainless steel. All other door hardware and accessories shall be satin bronze unless specified otherwise.

## 2.15 HARDWARE FOR FIRE DOORS

Hardware for fire doors shall conform to the requirements of NFPA 80 and NFPA 101.

## PART 3 EXECUTION

### 3.1 APPLICATION

Hardware shall be located in accordance with DHI-04 and DHI 05, except that deadlocks shall be mounted 1220 mm above finish floor. When approved, slight variations in locations or dimensions will be permitted. Application shall be in accordance with DHI-A115.1G or DHI A115-W. Door control devices for exterior doors such as closers and holders, shall be attached to doors with thru bolts and nuts or sex bolts. Alternate fastening methods may be approved by the Contracting Officer when manufacturers' documentation is submitted to verify that the fastening devices and door reinforcements are adequate to resist wind induced stresses. Electric hardware items and access control devices shall be installed in accordance with manufacturer's printed installation procedures.

#### 3.1.1 Hardware for Fire Doors and Smoke-Control Door Assemblies

Hardware for fire doors shall be installed in accordance with the requirements of NFPA 80. Exit devices installed on fire doors shall have a visible label bearing the marking "Fire Exit Hardware". Other hardware installed on fire doors, such as locksets, closers, and hinges shall have a visible label or stamp indicating that the hardware items have been approved by an approved testing agency for installation on fire-rated doors. Hardware for smoke-control door assemblies shall be installed in accordance with NFPA 105.

#### 3.1.2 Door-Closing Devices

Door-closing devices shall be installed and adjusted in accordance with the templates and printed instructions supplied by the manufacturer of the devices. Insofar as practicable, doors opening to or from halls and corridors shall have the closer mounted on the room side of the door.

#### 3.1.3 Key Control Storage Systems

Key control storage system shall be furnished to the Contracting Officer.

#### 3.1.4 Kick Plates and Mop Plates

Kick plates shall be installed on the push side of single-acting doors and on both sides of double-acting doors. Mop plates shall be installed on the pull side of the single acting doors.

#### 3.1.5 Auxiliary Hardware

Lever extension flush bolts shall be installed at the top and bottom of the inactive leaf of pairs of doors. The bottom bolt shall operate into a dust-proof floor strike or threshold.

#### 3.1.6 Thresholds

Thresholds shall be secured with a minimum of three fasteners per single door width and six fasteners per double door width with a maximum spacing of 300 mm. Exterior thresholds shall be installed in a bed of sealant with expansion anchors and stainless steel screws, except that bronze or anodized bronze thresholds shall be installed with expansion anchors with brass screws. Minimum screw size shall be No. 10 length, dependent on job conditions, with a minimum of 19 mm thread engagement into the floor or anchoring device used.

#### 3.1.7 Rain Drips

Door sill rain drips shall align with the bottom edge of the door. Overhead rain drips shall align with bottom edge of door frame rabbet. Drips shall be set in sealant and fastened with stainless steel screws.

#### 3.1.8 Weatherseals

Weatherseals shall be located as indicated, snug to door face and fastened in place with color matched metal screws after door and frames have been finish painted. Screw spacing shall be as recommended by manufacturer.

### 3.2 OPERATIONAL TESTS

Prior to acceptance of any electrical hardware system, an operational test shall be performed to determine if devices are operating as intended by the specifications. Wiring shall be tested for correct voltage, current carrying capacity, and proper grounding. Stray voltages in lock wiring shall be eliminated to prevent locking devices from releasing in critical situations.

### 3.3 FIELD QUALITY CONTROL

Supplier shall inspect the completed installation and certify that the hardware has been furnished and installed in accordance with the manufacturers' instructions and as specified. The inspection report shall identify any malfunctioning items and recommend adjustment or replacement as appropriate.

### 3.4 HARDWARE SETS

Dining Hall Schedule

HW-1	3ea	Hinges	A5111
	1ea	Lock Cylinder	(Type Required)
	1ea	Exit Device	Grade 1, Type 4, Function 04
	1ea	Closer	C02021xPT4G
	1ea	Drop Plate	
	1ea	Pull	J401 (1" Dia. x 18" ctc)
	1ea	Threshold	(see detail)
*Note: Weahterstrip and door bottom by door supplier			
HW-2	6ea	Hinges	A5111
	1ea	Lock Cylinder	(Type Required)
	1ea	Exit Device	Grade 1, Type 6, Function 05
	1ea	Exit Device	Grade 1, Type 6, Function 01
	2ea	Closeres	C02021xPT4G
	2ea	Drop Plate	
	2ea	Pulls	J401 (1" Dia x 18" ctc)
	1ea	Threshold	(see detail)
*Note: Weatherstrip and door bottom by door supplier			
HW-3	6ea	Hinges	A5111
	2ea	Closers	C02011
	2 set	Push/Pull	J504 (1" Dia. x 18" ctc)
	2ea	Stop	L12141
HW-4	3ea	Hinges	A5111
	1ea	Closer	C02011
	1 set	Push/Pull	J504 (1" Dia. x 18" ctc)
	1ea	Stop	L12141
HW-5	3ea	Hinges	A5111
	1ea	Lock Cylinder	(Type Required)
	1ea	Exit Device	Grade 1, Type 1, Function 08
	1ea	Closer	C02021xPT4G
	1ea	Kickplate	J102
	1 set	Weatherstrip	
	1ea	Door Bottom	
	1ea	Threshold	(see detail)
HW-6	3ea	Hinges	A5111
	1ea	Lockset	F09
	1ea	Closer	C02021xPT4G
	1ea	Kickplate	J102
	1 set	Weatherstrip	
	1ea	Door Bottom	
	1ea	Threshold	(see detail)
HW-7	3ea	Hinges	A5111
	1ea	Lockset	F13
	1ea	Closer	C02601xPT4G
	1ea	Kickplate	J102
	1 set	Weatherstrip	
	1ea	Door Bottom	
	1ea	Threshold	(see detail)

HW-8	6ea	Hinges	A5111
	1ea	Lockset	F07
	2ea	Flush Bolt	L14081
	2ea	Closer	C0261xPT4G
	2 set	Weatherstrip	
	1ea	Door Bottom	
	1ea	Threshold	(see detail)
HW-9	6ea	Hinges	A5111
	1ea	Lockset	F13
	2ea	Flush Bolt	L14081
	2ea	Closers	C02061xPT4G
	2ea	Armor Plate	J101
	1 set	Weatherstrip	
	2ea	Door Bottom	
	1ea	Threshold	(see detail)
HW-10	3ea	Hinges	A8112
	1ea	Lockset	F13
	1ea	Closer	C02011
	1ea	Kickplate	J102
	1ea	Stop	L12141
	3ea	Silencers	L03011
HW-11	3ea	Hinges	A8112
	1ea	Lockset	F04
	1ea	Stop	L12141
	3ea	Silencers	L03011
HW-12	6ea	Hinges	A8112
	1ea	Deadlock	F17
	2ea	Flush Bolts	L14081
	1ea	D.P. Strike	L14012
	2ea	Closer	C02601xPT4G
	2ea	Push Plate	J301
	2ea	Pull/Plate	J405 (1" Dia.)
	2ea	Kickplate	J102
	2ea	Silencers	L03011
HW-13	3ea	Hinges	A8111
	1ea	Closer	C02011
	1ea	Push Plate	J301
	1ea	Pull/Plate	J405 (1" Dia.)
	1ea	Kickplate	J102
	1ea	Stop	L12141
	3ea	Silencers	L03011
HW-14	3ea	Hinges	A8111
	1ea	Closer	C02061xPT4G
	1ea	Push Plate	J301
	1ea	Pull/Plate	J405 (1" Dia.)
	1ea	Strecher Plate	J102 (6")
	1ea	Kickplate	J102
	3ea	Silencers	L03011

HW-15	6ea	Hinges	A8111
	2ea	Closers	C02061xPT4G
	2ea	Push Plate	J301
	2ea	Strecher Plate	J102 (6")
	2ea	Kick Plate	J102
	2ea	Silencer	L03011

\*NOTE: One way door-no pull side operation

HW-16	6ea	Hinges	A8111
	2ea	Closers	C02061xPT4G
	2ea	Push Plate	J301
	2ea	Pull/Plate	J405 (1" Dia.)
	2ea	Strecher Plate	J102 (6")
	2ea	Kick Plate	J102
	2ea	Silencers	L03011

#### Central Chiller Schedule

HW-1	3ea	Hinges	A5111
	1ea	Lockset	F13
	1ea	Closer	C02061xPT4G
	1ea	Kick Plate	J102
	1 set	Weatherstrip	
	1ea	Door Bottom	
	1ea	Threshold	(see detail)

HW-2	3ea	Hinges	A8112
	1ea	Lockset	F04
	1ea	Stop	L12141
	3ea	Silencers	L03011

HW-3	3ea	Hinges	A8112
	1ea	Priv. Lock	F19
	1ea	Stop	L12141
	3ea	Silencers	L03011

HW-4 All hardware by door supplier

#### Battalion Headquarters

HW-1	6ea	Hinges	A5111
	1ea	Lock Cylinder	(Type Required)
	1ea	Exit Device	Grade 1, Type 6, Function 05
	1ea	Exit Device	Grade 1, Type 6, Function 01
	2ea	Closers	C02021xPT4G
	2ea	Drop Plate	
	2ea	Pulls	J401 (1" Dia. x 18: ctc)
	1ea	Threshold	(see detail)

\*NOTE: Weatherstrip and door bottom by door supplier

HW-2	6ea	Hinges	A5111
	2ea	Closers	C02021xPT4G
	2ea	Drop Plate	

	2 set	Push/Pulls	J504 (1" Dia. x 18" ctc)
HW-3	3ea	Hinges	A5111
	1ea	Lock Cylinder	(Type Required)
	1ea	Exit Device	Grade 1, Type 4, Function 04
	1ea	Closer	C02021xPT4G
	1ea	Drop Plate	
	1ea	Pull	J401 (1" Dia. x 18" ctc)
	1ea	Threshold	(see detail)
*NOTE: Weatherstrip and door bottom by door supplier			
HW-4	All hardware by door supplier		
HW-5	6ea	Hinges	A5111
	1ea	Lock Cylinder	(Type Required)
	1ea	Exit Device	Grade 1, Type 1, Function 03
	1ea	Exit Device	Grade 1, Type 1, Function 01
	1ea	Mullion	
	2ea	Closer	C02061xPT4G
	2ea	Pulls	J401 (1" Dia. x 18" ctc)
	2ea	Kick Plate	J102
	2 set	Weatherstrip	
	2ea	Door Bottom	
	1ea	Threshold	(see detail)
HW-6	6ea	Hinges	A5111
	1ea	Lockset	F07
	2ea	Flush Bolt	L14081
	2ea	Closer	C02061xPT4G
	1 set	Weatherstrip	
	2ea	Door Bottom	
	1ea	Astragal Seal	
	1ea	Threshold	(see detail)
HW-7	3ea	Hinges	A8112
	1ea	Lockset	F04
	1ea	Floor Stop	L12141
	3ea	Silencers	L03011
HW-8	Not Used		
HW-9	3ea	Hinges	A8112
	1ea	Lockset	F04
	1ea	Closer	C02011
	1ea	Kick Plate	J102
	1ea	Floor Stop	L12141
	3ea	Silencers	L03011
HW-10	3ea	Hinges	A8112
	1ea	Lockset	F05
	1ea	Closer	C02011
	1ea	Kick Plate	J102
	1ea	Floor Stop	L12141
	3ea	Silencers	L03011

HW-11	3ea	Hinges	A8112
	1ea	Lockset	F07
	1ea	Closer	C02011/C02021
	1ea	Floor Stop	L12141
	3ea	Silencers	L03011
HW-12	3ea	Hinges	A8112
	1ea	Priv. Lock	F19
	1ea	Floor Stop	L12141
	3ea	Silencers	L03011
HW-13	3ea	Hinges	A8111
	1ea	Closer	C02011
	1ea	Push Plate	J301
	1ea	Pull/Plate	J405 (1" Dia.)
	1ea	Kick Plate	J102
	1ea	Floor Stop	L12141
	1ea	Silencers	L03011
HW-14	3ea	Hinges	A5111
	1ea	Lockset	F13
	1ea	Closer	C02061xPT4G
	1ea	Kick Plate	J102
	1 set	Weatherstrip	
	1ea	Door Bottom	
	1ea	Threshold	(see detail)

## Barracks Building Schedule

## BK HW-1

3 pr Hinges, A5111 (NRP) Electric  
 2 ea Electromagnetic Lock, E28571, single lock, 1 armature per door  
 2 ea Exit device, Type 4, similar to F01 with monitor switch only, grade 1, (Provide back-up switch on frame)  
 2 ea Key switch, Dorma K701-6-MA or equal  
 1 ea Power backup, Dorma RB 12v4 battery or equal  
 2 ea Closers, C22021xPT4C and PT4D  
 2 ea Stops (See details 15 and 16 on Sheet A6.2)  
 1 ea Threshold, Pemko 257B or equal  
 2 ea Pulls, J401  
 2 ea Sweeps, Pemko 307DV or equal  
 1 set Weatherstripping, dark brown  
 1 ea Rain Drips top and bottom (match door and frame color)  
 2 ea Door shoes, Pemko 216DV or equal

## BK HW-2

1 ½ pr Hinges, A5111 (NRP) Electric  
 1 ea Electormagnetic Lock, E28751, single lock  
 1 ea Exit device, Type 4 similar to F01 with monitor switch only, grade 1, (Provide back-up switch on frame)  
 1 ea Key switch, Dorma K701-6-MA or equal

1 ea Power back-up, Dorma RB 12v4 battery or equal  
 2 ea Closer, C2202 x PT4D  
 2 ea Stop, L02101  
 1 ea Kick Plate, J102  
 1 ea Pull, J401

## BK HW-3

1 ½ pr Hinges, A5112 (NRP)  
 1 ea Exit device, Type 10, Function B, Grade 1, lever handle  
 1 ea Closer, C02021XPT4D  
 1 ea Stop, TRIMCO 1209W (wall mount) for door 103 only.  
 See details 15 and 16 on Sheet A6.2 for all others  
 1 ea Threshold, Pemko 257B or equal  
 1 ea Sweep, Pemko 307DV or equal  
 1 set Weatherstripping, dark brown  
 1 ea Rain Drips top and bottom (match door and frame color)  
 1 ea Door shoe, Pemko 216DV or equal

## BK HW-4

3 pr Hinges, A5111 (NRP) Electric  
 2 ea Electromagnetic Lock, E08571, single lock, 1 armature per door  
 2 ea Exit device, Type 1, similar to F01 with monitor switch only,  
 grade 1, (Provide back-up switch on frame)  
 2 ea Key switch, Dorma K701-6-MA or equal  
 1 ea Power backup, Dorma RB 12v4 battery or equal  
 2 ea Closers, C02021xPT4D  
 2 ea Stops, TRIMCO 1209W (wall mount) for door 116 only.  
 See details 15 and 16 on Sheet A6.2 for all others  
 1 ea Threshold, Pemko 257B or equal  
 2 ea Pulls, J401  
 2 ea Sweeps, Pemko 307DV or equal  
 1 set Weatherstripping, dark brown  
 1 ea Rain Drips top and bottom (match door and frame color)  
 2 ea Door shoes, Pemko 216DV or equal

## BK HW-5

3 pr Hinges, A5112 (NRP)  
 1 ea Lockset, F86, Grade 1  
 2 ea Closers, C02021xPT4D  
 1 ea Lever extension, flushbolts, L14081  
 1 ea Threshold, Pemko 257B or equal  
 2 ea Sweep, Pemko 307DV or equal  
 2 set Weatherstripping, dark brown  
 2 ea Rain Drips top and bottom (match door and frame color)  
 2 ea Stops, see details 15 and 16 on Sheet A6.2  
 2 ea Door shoes, Pemko 216DV or equal

## BK HW-6

1 ½ pr Hinges, A5112  
 1 ea Lockset F13



1 ea Kick plate, J102  
1 ea Closer, C02011xPT4G  
3 ea Silencers, L03011  
1 ea Threshold (See details)

BK HW-7

NOT USED

BK HW-8

1 ½ pr Hinges, A5111  
1 ea Latchset, F75 (hospitality, push/pull)  
1 ea Closer, C02011  
1 ea Stop, L02101  
2 ea Kick plate, J102  
3 ea Silencers, 103011

BK HW-9

1 ½ pr Hinges, A5112  
1 ea Lockset, F04  
1 ea Stop, L52101  
3 ea Silencers, L03011

BK HW-10

1 ½ pr Hinges, A8111  
1 ea Latchset, F81, lever  
1 ea Closer, C02011xPT4D  
1 ea Stop, L52101

BK HW-11

3 pr Hinges, A8111  
1 ea Lockset, F81, lever  
1 ea Lever extension, flushbolts, L14081  
1 ea Dustproof strike, L04011  
2 ea Stops, L52101

BK HW-12

1 ½ pr Hinges, A8111  
1 ea Lockset, F81, lever  
1 ea Stop, L52101  
1 ea Closer, C02011  
3 ea Silencers, L03011

BK HW-13

1 ½ pr Hinges, A8111  
1 ea Lockset, F36  
1 ea Stop, L52101  
1 ea Closer, C02011

3 ea Silencers, L03011

BK HW-14

1 ½ pr Hinges, A8111

1 ea Lockset, F84

1 ea Closer, NORTON 7214MPDI Electro-magnetic closer/holder or equal

1 ea Stop, L52101

1 ea Kickplate, J102

3 ea Silencers, L03011

BK HW-15

3 pr Hinges, A8112

2 ea Lockset, F81, lever

1 ea Lever extension, flushbolts, L04081

1 ea Closer, C02021

1 ea Dustproof strike, L04011

2 ea Stops, L52101

3 ea Silencers, L03011

BK HW-16

1 ½ pr Hinges, A8111

1 ea Exit Device, Type 1, Passage function, grade 1, lever

1 ea Closer, NORTON 7214MPDI Electro-magnetic closer/holder or equal

1 ea Kickplate, J102

1 ea Stop, TRIMCO 1209W (wall mount)

-- End of Section --

## SECTION 08810

GLASS AND GLAZING  
05/97

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI Z97.1 (1984; R 1994) Safety Performance  
Specifications and Methods of Test for Safety  
Glazing Materials Used in Buildings

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 509 (1994) Elastomeric Cellular Preformed Gasket  
and Sealing Material

ASTM C 669 (1995) Glazing Compounds for Back Bedding and  
Face Glazing of Metal Sash

ASTM C 864 (1993) Dense Elastomeric Compression Seal  
Gaskets, Setting Blocks, and Spacers

ASTM C 920 (1995) Elastomeric Joint Sealants

ASTM C 1036 (1991) Flat Glass

ASTM C 1048 (1992) Heat-Treated Flat Glass - Kind HS,  
Kind FT Coated and Uncoated Glass

ASTM C 1172 (1996) Laminated Architectural Flat Glass

ASTM C 1349 (1996) Architectural Flat Glass Clad  
Polycarbonate

ASTM D 395 (1989; R 1994) Rubber Property - Compression  
Set

ASTM E 119 (1995a) Fire Tests of Building Construction  
and Materials

ASTM E 773 (1988) Seal Durability of Sealed Insulating  
Glass Units

ASTM E 774 (1992) Sealed Insulating Glass Units

ASTM E 1300	(1994) Determining the Minimum Thickness and Type of Glass Required to Resist a Specified Load
AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)	
ASCE 7	(1995) Minimum Design Loads for Buildings and Other Structures
CODE OF FEDERAL REGULATIONS (CFR)	
16 CFR 1201	Safety Standard for Architectural Glazing Materials
COMMERCIAL ITEM DESCRIPTION (CID)	
CID A-A-378	(Basic) Putty Linseed Oil Type, (for Wood-Sash-Glazing)
GLASS ASSOCIATION OF NORTH AMERICA (GANA)	
GANA-01	(1997) Glazing Manual
GANA-04	(1995) Engineering Standards Manual
NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)	
NFPA 80	(1995) Fire Doors and Fire Windows
NFPA 252	(1995) Fire Tests of Door Assemblies
NFPA 257	(1996) Fire Tests for Window and Glass Block Assemblies

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

SD-02 Shop Drawings

Glazing Materials and Accessories

Drawings showing complete details of the proposed setting methods, mullion details, edge blocking, size of openings, frame details, materials, and types and thickness of glass.

## SD-03 Product Data

Glass; GA-BK, GA-CH, GA-DN, GA-HQ Glazing Accessories; GA-BK, GA-CH, GA-DN, GA-HQ

Manufacturer's descriptive product data, handling and storage recommendations, installation instructions, and cleaning instructions.

## SD-04 Samples

Glass; GA-BK, GA-CH, GA-DN, GA-HQ.

Two 203 x 254 mm samples of each of the following: tinted glass, and insulating glass units.

## SD-07 Certificates

Glass

Certificates stating that the glass meets the specified requirements. Labels or manufacturers marking affixed to the glass will be accepted in lieu of certificates.

Certificates from the manufacturer attesting that the units meet the luminous and solar radiant transmission requirements for heat absorbing glass.

## 1.3 SYSTEM DESCRIPTION

Glazing systems shall be fabricated and installed watertight and airtight to withstand thermal movement and wind loading without glass breakage, gasket failure, deterioration of glazing accessories, and defects in the work. Glazed panels shall comply with the safety standards, as indicated in accordance with ANSI Z97.1. Glazed panels shall comply with indicated wind/snow loading in accordance with ASTM E 1300.

## 1.4 DELIVERY, STORAGE AND HANDLING

Glazing compounds shall be delivered to the site in the manufacturer's unopened containers. Glass shall be stored indoors in a safe, well ventilated dry location in accordance with manufacturer's instructions, and shall not be unpacked until needed for installation. Glass shall not be stored on site over 1 month.

## 1.5 PROJECT/SITE CONDITIONS

Glazing work shall not be started until outdoor temperature is above 5 degrees C and rising, unless procedures recommended by glass manufacturer and approved by Contracting Officer are made to warm the glass and rabbet surfaces. Ventilation shall be provided to prevent condensation of moisture on glazing work during installation. Glazing work shall not be performed during damp or raining weather.

## 1.6 WARRANTY

### 1.6.1 Insulating Glass

Manufacturer shall warrant the insulating glass to be free of fogging or film formation on the internal glass surfaces caused by failure of the hermetic seal for a period of 10 years from Date of Substantial Completion. Warranty shall be signed by manufacturer.

## PART 2 PRODUCTS

### 2.1 INSULATING GLASS

Insulating glass shall be Class A preassembled units of dual-seal construction consisting of lites of glass separated by an aluminum, spacer and dehydrated space conforming to ASTM E 773 and ASTM E 774. Spacer shall be roll-formed, with bent or tightly welded or keyed and sealed joints to completely seal the spacer periphery and eliminate moisture and hydrocarbon vapor transmission into airspace through the corners. Primary seal shall be compressed polyisobutylene and the secondary seal shall be a specially formulated silicone. All units shall be argon gas filled. Insulated units shall have 6 mm tinted laminated glass on exterior lite and 6 mm clear laminated glass on interior lite. Glass types shall be as follows:

#### 2.1.1 Low-E Insulating Glass (All exterior Aluminum Doors and Storefront)

Interior and exterior glass panes for Low-E insulating units shall be fully tempered flat glass. Class 1-clear for interior light and Class 2-tinted for out board lite with anti-reflective low-emissivity coating on No. 3 surface, Quality q3 - glazing select, conforming to ASTM C 1036. Color of tinted glass shall be as shown in COLOR SCHEDULE. Interior and exterior lites shall be 6 mm thick with 13 mm air space between them.

### 2.2 HEAT-TREATED GLASS

#### 2.2.1 Tempered Glass

Tempered glass shall be kind FT fully tempered transparent flat type, Class 1-clear and 2-tinted, Condition A uncoated surface, Quality q3 - glazing select, conforming to ASTM C 1048 and GANA Standards Manual. Color of tinted glass shall be as shown in Finish Schedule.

### 2.3 LAMINATED GLAZINGS

#### 2.3.1 Laminated Glass (All Insulating Units and Interior Glazing)

Laminated glass shall consist of two layers of Type I transparent float glass, Class 1-clear and 2-tinted Quality q3 - glazing select, conforming to ASTM C 1036. Glass shall be bonded together with 60 mil thick PVB interlayer under pressure, conforming to requirements of 16 CFR 1201 and ASTM C 1172. Color shall be bronze as shown in COLOR SCHEDULE.

### 2.4 MIRRORS

#### 2.4.1 Glass Mirrors

Glass for mirrors shall be Type I transparent flat type, Class 1-clear, Glazing Quality q1 6 mm thick conforming to ASTM C 1036. Glass color shall be clear. Glass shall be coated on one surface with silver coating, copper protective coating, and mirror backing paint. Silver coating shall be highly adhesive pure silver coating of a thickness which shall provide reflectivity of 83 percent or more of incident light when viewed through 6 mm thick glass, and shall be free of pinholes or other defects. Copper protective coating shall be pure bright reflective copper, homogeneous without sludge, pinholes or other defects, and shall be of proper thickness to prevent "adhesion pull" by mirror backing paint. Mirror backing paint shall consist of two coats of special scratch and abrasion-resistant paint, and shall be baked in uniform thickness to provide a protection for silver and copper coatings which will permit normal cutting and edge fabrication.

#### 2.4.2 Mirror Accessories

##### 2.4.2.1 Mastic

Mastic for setting mirrors shall be a polymer type mirror mastic resistant to water, shock, cracking, vibration and thermal expansion. Mastic shall be compatible with mirror backing paint, and shall be approved by mirror manufacturer.

##### 2.4.2.2 Mirror Frames

Full height mirrors shall be provided with mirror frames (J-mold channels) fabricated of one-piece roll-formed Type 304 stainless steel with No. 4 brushed satin finish and concealed fasteners which will keep mirrors snug to wall. Frames shall be 32 x 6 x 6 mm continuous at bottom of mirrors. Concealed fasteners of type to suit wall construction material shall be provided with mirror frames.

##### 2.4.2.3 Mirror Clips

Concealed fasteners of type to suit wall construction material shall be provided with clips.

#### 2.5 GLAZING ACCESSORIES

##### 2.5.1 Preformed Tape

Preformed tape shall be elastomeric rubber extruded into a ribbon of a width and thickness suitable for specific application. Tape shall be of type which will remain resilient, have excellent adhesion, and be chemically compatible to glass, metal, or wood.

##### 2.5.2 Sealant

Sealant shall be elastomeric conforming to ASTM C 920, Type S or M, Grade NS, Class 12.5, Use G, of type chemically compatible with setting blocks, preformed sealing tape and sealants used in manufacturing insulating glass. Color of sealant shall be as shown in COLOR SCHEDULE.

#### 2.5.2.1 Butt Glazing Sealant

For butt glazing provide one-part acid curing silicone rubber elastomeric sealant: Type S; Grade NS; Class 25; Uses NT, G, and A.

#### 2.5.3 Glazing Gaskets

Glazing gaskets shall be extruded with continuous integral locking projection designed to engage into metal glass holding members to provide a watertight seal during dynamic loading, building movements and thermal movements. Glazing gaskets for a single glazed opening shall be continuous one-piece units with factory-fabricated injection-molded corners free of flashing and burrs. Glazing gaskets shall be in lengths or units recommended by manufacturer to ensure against pull-back at corners. Glazing gasket profiles shall be as indicated on drawings.

##### 2.5.3.1 Fixed Glazing Gaskets

Fixed glazing gaskets shall be closed-cell (sponge) smooth extruded compression gaskets of cured elastomeric virgin neoprene compounds conforming to ASTM C 509, Type 2, Option 1.

##### 2.5.3.2 Wedge Glazing Gaskets

Wedge glazing gaskets shall be high-quality extrusions of cured elastomeric virgin neoprene compounds, ozone resistant, conforming to ASTM C 864, Option 1, Shore A durometer between 65 and 75.

##### 2.5.3.3 Aluminum Framing Glazing Gaskets

Glazing gaskets for aluminum framing shall be permanent, elastic, non-shrinking, non-migrating, watertight and weathertight.

#### 2.5.4 Putty and Glazing Compound

Glazing compound shall conform to ASTM C 669 for face-glazing metal sash. Putty shall be linseed oil type conforming to CID A-A-378 for face-glazing primed wood sash. Putty and glazing compounds shall not be used with insulating glass or laminated glass.

#### 2.5.5 Setting and Edge Blocking

Neoprene setting blocks shall be dense extruded type conforming to ASTM D 395, Method B, Shore A durometer between 70 and 90. Edge blocking shall be Shore A durometer of 50 (+ or - 5). Silicone setting blocks shall be required when blocks are in contact with silicone sealant. Profiles, lengths and locations shall be as required and recommended in writing by glass manufacturer.

### PART 3 EXECUTION

#### 3.1 PREPARATION



Openings and framing systems scheduled to receive glass shall be examined for compliance with approved shop drawings, GANA-01 and glass manufacturer's recommendations including size, squareness, offsets at corners, presence and function of weep system, face and edge clearance requirements and effective sealing between joints of glass-framing members. Detrimental materials shall be removed from glazing rabbet and glass surfaces and wiped dry with solvent. Glazing surfaces shall be dry and free of frost.

### 3.2 INSTALLATION

Glass and glazing work shall be performed in accordance with approved shop drawings, GANA-01, glass manufacturer's instructions and warranty requirements. Glass shall be installed with factory labels intact and removed only when instructed. Wired glass and fire/safety rated glass shall be installed in accordance with NFPA 80. Edges and corners shall not be ground, nipped or cut after leaving factory. Springing, forcing or twisting of units during installation will not be permitted.

### 3.3 CLEANING

Upon completion of project, outside surfaces of glass shall be washed clean and the inside surfaces of glass shall be washed and polished in accordance with glass manufacturer's recommendations.

### 3.4 PROTECTION

Glass work shall be protected immediately after installation. Glazed openings shall be identified with suitable warning tapes, cloth or paper flags, attached with non-staining adhesives. Reflective glass shall be protected with a protective material to eliminate any contamination of the reflective coating. Protective material shall be placed far enough away from the coated glass to allow air to circulate to reduce heat buildup and moisture accumulation on the glass. Glass units which are broken, chipped, cracked, abraded, or otherwise damaged during construction activities shall be removed and replaced with new units.

-- End of Section --

## DIVISION 9 – FINISHES

09250	Gypsum Wallboard
09310	Ceramic Tile
09510	Acoustical Ceilings
09521	Acoustical Wall Systems
09650	Resilient Flooring
09680	Carpet
09720	Wallcoverings
09900	Painting, General
09910	Textured Acrylic Wallcoating
09911	Fiberglass Reinforced Plastic (FRP) Panels
09912	Acrylic Latex Concrete Stain and Concrete Stain Sealer
09920	Contractor Color Boards
09930	Decorative Acidic -Based Concrete Stain and Finish

## SECTION 09250

## GYPSUM WALLBOARD

**06/97**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

- |              |   |
|--------------|---|
| ANSI A108.11 | (1992) Interior Installation of Cementitious Backup Units           |
| ANSI A118.9  | (1992) Test Methods and Specifications for Cementitious Backer Unit |

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

- |                   |  |
|-------------------|--|
| ASTM A 580/A 580M | (1995a) Stainless Steel Wire   |
| ASTM A 853        | (1993) Steel Wire, Carbon, for General Use   |
| ASTM B 164        | (1993) Nickel-Copper Alloy Rod, Bar, and Wire  |
| ASTM C 36         | (1997) Gypsum Wallboard  |
| ASTM C 79/C 79M   | (1997) Treated Core and Nontreated Core Gypsum Sheathing Board                               |
| ASTM C 475        | (1994) Joint Compound and Joint Tape for Finishing Gypsum Board                              |
| ASTM C 514        | (1996) Nails for the Application of Gypsum Board   |
| ASTM C 557        | (1993a) Adhesive for Fastening Gypsum Wallboard to Wood Framing                              |
| ASTM C 630/C 630M | (1996a) Water-Resistant Gypsum Backing Board   |
| ASTM C 645        | (1996a) Nonstructural Steel Framing Members  |
| ASTM C 754        | (1997) Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products |
| ASTM C 840        | (1996) Application and Finishing of Gypsum   |

## Board

ASTM C 931/C 931M	(1995a) Exterior Gypsum Soffit Board
ASTM C 955	(1996a) Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases
ASTM C 960/C 960M	(1996) Predecorated Gypsum Board
ASTM C 1002	(1996a) Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases
ASTM C 1047	(1995) Accessories for Gypsum Wallboard and Gypsum Veneer Base

## GYPSUM ASSOCIATION (GA)

GA 216	(1996) Application and Finishing of Gypsum Board
GA 600	(1997) Fire Resistance Design Manual

## UNDERWRITERS LABORATORIES (UL)

UL Fire Resist Dir	(1998) Fire Resistance Directory
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## 1.2 SYSTEM DESCRIPTION

## 1.2.1 Fire-Rated Construction

Joints of fire-rated gypsum board enclosures shall be closed and sealed in accordance with UL test requirements or GA requirements, and as required to meet pressurization requirements. Penetrations through rated partitions and ceilings shall be sealed tight in accordance with tested systems. Fire ratings shall be as indicated.

## 1.2.2 Pressurized Enclosures

Pressurized fire-rated gypsum board enclosures shall allow the mechanical and electrical life-safety systems to operate in accordance with the design intent. Air pressure within elevator shaft shall be 360 Pa. Air pressure within stair shaft shall be 240 Pa. Maximum mid-span deflection shall be  $L/360$ .

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete

system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

#### SD-07 Certificates

Exterior Sheathing Board

Fire-Rated Gypsum Board

Impact Resistant Gypsum Board

Sound Attenuation Insulation

Shaftwall Liner Panel

Certificates stating that the steel framing insulation and gypsum wallboard meet the specified requirements.

#### 1.4 QUALIFICATIONS

Manufacturer shall specialize in manufacturing the types of material specified and shall have a minimum of 5 years of documented successful experience. Installer shall specialize in the type of gypsum board work required and shall have a minimum of 3 years of documented successful experience.

#### 1.5 DELIVERY, STORAGE AND HANDLING

Materials shall be delivered in original containers bearing the name of manufacturer, contents, and brand name. Materials shall be stored off the ground in a weathertight structure for protection. Gypsum boards shall be stacked flat, off floor and supported to prevent sagging and warpage. Adhesives and joint materials shall be stored in accordance with manufacturer's printed instructions. Damaged or deteriorated materials shall be removed from jobsite.

#### 1.6 ENVIRONMENTAL CONDITIONS

Environmental conditions for application and finishing of gypsum board shall be in accordance with ASTM C 840. During the application of gypsum board without adhesive, a room temperature of not less than 4 degrees C shall be maintained. During the application of gypsum board with adhesive, a room temperature of not less than 10 degrees C shall be maintained for 48 hours prior to application and continuously afterwards until completely dry. Building spaces shall be ventilated to remove water not required for drying joint treatment materials. Drafts shall be avoided during dry hot weather to prevent materials from drying too rapidly.

## PART 2 MATERIALS

## 2.1 NON-LOADBEARING STUD WALLS

### 2.1.1 Studs

Studs for non-loadbearing walls shall conform to ASTM C 645. Studs shall be C-shaped, roll formed steel with minimum uncoated design thickness of 20 gauge made from G40 hot-dip galvanized coated sheet.

### 2.1.2 Runner Tracks

Floor and ceiling runner tracks shall conform to ASTM C 645. Tracks shall be prefabricated, U-shaped with minimum 25 mm flanges, unpunched web, thickness to match studs, made from G40 hot-dip galvanized coated sheet.

## 2.2 SOUND ATTENUATION INSULATION

Sound attenuation blanket insulation shall conform to ASTM C 665, Type I, 90 mm thick.

## 2.3 SUSPENDED CEILING FRAMING

Suspended ceiling framing system shall have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. The suspension system shall have a maximum deflection of  $L/240$ . Carrying channels shall be formed from minimum 1.40 mm thick cold-rolled steel, 38 x 19 mm. Furring members shall be formed from cold-rolled steel, 22 x 65 mm. Carrying channels and furring members shall be made from hot-dip galvanized coated sheet.

## 2.4 GYPSUM BOARD

Gypsum board shall have square-cut ends, tapered or beveled edges and shall be maximum possible length. Gypsum board thickness shall be as shown.

### 2.4.1 Fire-Rated Gypsum Board

Fire-rated gypsum board shall conform to ASTM C 36, and shall be Type X or Type C as required, 1200 mm wide.

### 2.4.2 Shaftwall Liner Panel

Shaftwall liner panel shall conform to UL listing. Liner Panel shall be specifically manufactured for cavity shaftwall system, with water-resistant paper faces, bevel edges, single lengths to fit required conditions, 25.4 mm thick, by 600 mm wide.

### 2.4.3 Impact Resistant Gypsum Board

1200 mm wide, 15.9 mm thick, tapered edges. Reinforced gypsum panel with imbedded fiber mesh or lexan backing. Provide fasteners that meet manufacturer requirements.

### 2.4.4 Exterior Sheathing Board

Exterior sheathing board shall conform to ASTM C 79/C 79M, Type X, shall have water-resistant core, water-repellant paper faces each side, with tongue-and-groove edges, and be 600 mm wide, or square edges and 1200 mm wide.

## 2.5 TRIM, MOLDINGS, AND ACCESSORIES

### 2.5.1 Taping and Embedding Compound

Taping and embedding compound shall conform to ASTM C 475. Compound shall be specifically formulated and manufactured for use in embedding tape at gypsum wallboard joints and fastener heads, and shall be compatible with tape and substrate.

### 2.5.2 Finishing or Topping Compound

Finishing or topping compound shall conform to ASTM C 475. Compound shall be specifically formulated and manufactured for use as a finishing compound for gypsum board.

### 2.5.3 All-Purpose Compound

All-purpose compound shall be specifically formulated and manufactured to use as a taping and finishing compound, and shall be compatible with tape and substrate.

### 2.5.4 Joint Tape

Joint tape shall conform to ASTM C 475 and shall be as recommended by gypsum board manufacturer.

### 2.5.5 Trim, Control Joints, Beads, Stops and Nosings

Items used to protect edges, corners, and to provide architectural features shall be in accordance with ASTM C 1047.

## 2.6 FASTENINGS AND ADHESIVES

### 2.6.1 Nails

Nails shall conform to ASTM C 514. Nails shall be hard-drawn low or medium-low carbon steel, suitable for intended use. Special nails for predecorated gypsum board shall be as recommended by predecorated gypsum board manufacturer.

### 2.6.2 Screws

Screws shall conform to ASTM C 1002. Screws shall be self-drilling and self-tapping steel, Type G for gypsum board to gypsum board Type S for wood or light-gauge steel framing Type W for wood framing.

### 2.6.3 Adhesives

Adhesives shall conform to ASTM C 557. Adhesives shall be formulated to

bond gypsum board to wood framing members. For securing gypsum board to metal framing, adhesive shall be as recommended by gypsum board manufacturer.

#### 2.6.4 Hangers

Suspended ceiling runner channel hangers shall be soft, annealed steel wire not less than No. 8 SWG, conforming to ASTM A 853 or flat iron or steel straps, at least 2 x 22 mm size, coated with zinc, cadmium, or rust-inhibiting paint.

#### 2.6.5 Wire and Clip Type Fastenings

Tie wire, clips, rings, and other fastenings shall be corrosion-resisting steel conforming to ASTM A 580/A 580M, composition 302, 304, or 316, Condition A, or nickel-copper alloy conforming to ASTM B 164, annealed condition except that walls, partitions, and other vertical surfaces not incorporated in ceiling construction may be erected with soft, annealed steel conforming to ASTM A 853.

##### 2.6.5.1 Tie Wire

Tie wire for constructing partitions and vertical furring, for securing metal lath to supports, and for lacing shall be not less than No. 18 SWG. Tie wire for other applications shall be not less than No. 16 SWG.

##### 2.6.5.2 Clips

Clips used in lieu of tie wire for securing the furring channels to the runner channels in ceiling construction shall be made from strip not less than 3 mm thick or shall be hairpin clip, formed of wire not less than 0.4 mm nominal diameter. Other clips and rings or fastenings of similar materials shall be equivalent in holding power to that provided by tie wire for the specific application.

#### 2.7 CEMENTITIOUS BACKER UNITS

Cementitious backer units shall comply with ANSI A118.9.

### PART 3 EXECUTION

#### 3.1 INTERIOR WALL FRAMING

Steel framing and furring members shall be installed in accordance with ASTM C 754. Members shall be in alignment with spacings not to exceed the maximum spacings indicated on drawings. Runners shall be aligned accurately at the floor and ceiling and securely anchored.

##### 3.1.1 Wall Openings

The framing system shall provide for the installation and anchorage of the required subframes or finish frames for wall openings at doors, pass-through openings, and access panels. Partitions abutting continuous suspended ceilings shall be strengthened for rigidity at rough openings of more than 750 mm wide. Studs at openings shall be 0.84 mm minimum bare metal



thickness and spot grouted at jamb anchor inserts. Double studs shall be fastened together with screws and secured to floor and overhead runners. Two studs shall be used for framing solid-core doors, doors over 900 mm wide and extra-heavy doors such as X-ray room doors.

### 3.1.2 Wall Control Joints

Control joints for expansion and contraction in the walls shall be constructed with double studs installed 13 mm apart in interior walls or wall furrings where indicated on drawings. Control joint spacing shall not exceed 9 m. Ceiling-height door frames may be used as vertical control joints. Door frames of less than ceiling height may be used as control joints only if standard control joints extend to ceiling from both corners of top of door frame. Control joints between studs shall be filled with firesafing insulation in fire rated partitions.

### 3.1.3 Blocking

Blocking shall be provided as necessary for mounted equipment. Blocking shall be metal or wood and shall be cut to fit between framing members. Blocking shall be rigidly anchored to the framing members. Under no circumstances will accessories or other wall mounted equipment be anchored directly to gypsum wallboard.

## 3.2 SHAFT WALL FRAMING

The shaft wall system shall be installed in accordance with the system manufacturer's published instructions. Bucks, anchors, blocking and other items placed in or behind shaft wall framing shall be coordinated with electrical and mechanical work. Fireproofing materials which are damaged or removed during shaft wall construction shall be patched or replaced.

## 3.3 SUSPENDED CEILING FRAMING

Suspended ceiling system framing shall be installed in accordance with ASTM C 754.

### 3.3.1 Hangers

Hangers shall be spaced not more than 1200 mm along runner channels and 900 mm in the other direction or 1050 mm in both directions unless otherwise indicated. Locations of hanger wires shall be coordinated with other work. Hangers at ends of runner channels shall be located not more than 150 mm from wall. Hanger wire shall be looped around bottom chord of open-web steel joists, or secured to structural elements with suitable fasteners. Sags or twists which develop in the suspended system shall be adjusted. Damaged or faulty parts shall be replaced.

### 3.3.2 Main Runners

Main runner channels shall be installed in accordance with ASTM C 754. Hanger wires shall be double strand saddle-tied to runner channels and the ends of hanger wire shall be twisted three times around itself. Main runners shall be located to within 150 mm of the paralleling wall to support

the ends of cross furring. Main runners shall not come in contact with abutting masonry or concrete walls. Where main runners are spliced, ends shall be overlapped 300 mm with flanges of channels interlocked, and shall be securely tied at each end of splice with wire looped twice around the channels.

### 3.3.3 Furring Channels

Furring channels shall be spaced in accordance with ASTM C 754. Furring channels shall be secured to the runner channels and to structural supports at each crossing with tie wire, hairpin clips, or equivalent fastenings. Furring channels shall be located within 50 mm of parallel walls and beams, and shall be cut 13 mm short of abutting walls.

### 3.3.4 Ceiling Openings

Support members shall be provided as required at ceiling openings for access panels, recessed light fixtures, and air supply or exhaust. Support members shall be not less than 38 mm main runner channels and vertically installed suspension wires or straps shall be located to provide at least the minimum support specified herein for furring and wallboard attachment. Intermediate structural members not a part of the structural system, shall be provided for attachment or suspension of support members.

### 3.3.5 Light Fixtures and Air Diffusers

Light fixtures and air diffusers shall be supported directly from suspended ceiling runners. Wires shall be provided at appropriate locations to carry the weight of recessed or surface mounted light fixtures and air diffusers.

### 3.3.6 Control Joints

Ceiling control joints for expansion and contraction shall be located where indicated on drawings. A control joint or intermediate blocking shall be installed where ceiling framing members change direction.

#### 3.3.6.1 Interior Ceilings With Perimeter Relief

Control joints shall be installed so that linear dimensions between control joints shall not exceed 15 m in either direction nor more than 230 square meters.

## 3.4 APPLICATION OF GYPSUM BOARD

Gypsum board shall be installed in accordance with ASTM C 840 and GA 216 and as specified. Paragraph 17.3.1 GENERAL of ASTM C 840 which permits usage of water resistant gypsum board as a base for adhesive application of ceramic or plastic tile on ceilings, does not apply. Edges and ends of gypsum boards shall be cut to obtain neat fitting joints. End joints of adjoining boards shall be staggered, and shall be staggered on opposite sides of wall.

Boards shall be applied with moderate contact without forcing in place. Holes for pipes, fixtures or other small openings shall be cut with a tool which will provide a neat fit. Screws shall be driven so that the heads are slightly below the plane of paper face. Fracturing the paper face or

damaging the core shall be avoided. Trim shall be installed at external and internal angles formed by the intersecting gypsum board surfaces with other surfaces. Corner beads shall be installed to vertical and horizontal corners in accordance with manufacturer's published instructions.

#### 3.4.1 Two-Ply Gypsum Board

Second layer of gypsum board shall be applied perpendicular to first layer with joints staggered and secured with mechanical fasteners adhesive. The use of adhesive shall be in accordance with ASTM C 840.

#### 3.4.2 Adhesively-Applied Gypsum Board

Walls scheduled to receive adhesively-applied gypsum board shall be dry, free of dust, oil, or form release agents, protrusions or voids, or foreign matter that would affect a proper bond.

#### 3.4.3 Exterior Gypsum Sheathing

Exterior gypsum sheathing shall be flashed at openings so that water intrusion will not contact the sheathing. Vertical end and edge joints shall abut over the centers of framing members and shall be offset a minimum of one framing space between adjacent rows of gypsum sheathing. Sheathing shall be installed in accordance with manufacturer's instructions.

### 3.5 SOUND-RATED WORK

Prior to installing gypsum board provide continuous beads of acoustical sealant at juncture of both faces of runners and plates with floor and ceiling construction and whenever work abuts dissimilar materials. Where sound-rated partitions intersect non-rated partitions extend rated construction through non-rated work to completely close sound flanking paths.

#### 3.5.1 Control Joints

At control joints, provide continuous bead of acoustical sealant between edges of gypsum boards.

#### 3.5.2 Openings and Cutouts

At openings and cutouts, fill open spaces between edges of gypsum boards and fixtures, cabinets, ducts, and other flush and penetrating items with continuous bead of acoustical sealant. Seal sides and backs of electrical boxes to completely close openings and joints with acoustical sealant.

### 3.6 TRIM, MOLDINGS, AND ACCESSORIES INSTALLATION

Trim, moldings and accessories shall be installed in accordance with GA 216.

### 3.7 APPLICATION OF CEMENTITIOUS BACKER UNITS

Cementitious backer units shall be installed in accordance with ANSI A108.11. Fasteners shall be the type designed for cement board application.

### 3.8 TAPING AND FINISHING

Gypsum board taping and finishing shall be performed in accordance with ASTM C 840. Boards shall be kept free of dirt, oil and other foreign matter that could cause a lack of bond. Screw heads, dents, gouges, and cut-outs shall be filled with joint compound and sanded. Accessories at exposed joints, edges, corners, openings, and similar locations shall be taped, floated with joint compound, and sanded to produce surfaces ready for gypsum board finishes.

### 3.9 FIRE-RESISTANT ASSEMBLIES

Gypsum wallboard construction for fire-rated assemblies shall be in accordance with UL Fire Resist Dir, or GA 600 for the design number indicated on drawings.

### 3.10 PATCHING

Surface defects and damage shall be corrected as required to leave gypsum board smooth, uniform in appearance, and ready to receive finish as specified.

-- End of Section --

## SECTION 09310

CERAMIC TILE  
07/98

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

ANSI A108.1A	(1992) Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar
ANSI A108.1B	(1992) Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar
ANSI A108.4	(1992) Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile Setting Epoxy Adhesive
ANSI A108.5	(1992) Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar
ANSI A108.6	(1992) Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and Grouting Epoxy
ANSI A108.7	(1992) Electrically Conductive Ceramic Tile Installed with Conductive Dry-Set Portland Cement Mortar
ANSI A108.8	(1992) Installation of Ceramic Tile with Chemical Resistant Furan Mortar and Grout
ANSI A108.10	(1992) Installation of Grout in Tilework
ANSI A118.1	(1992) Dry-Set Portland Cement Mortar
ANSI A118.2	(1992) Conductive Dry-Set Portland Cement Mortar
ANSI A118.3	(1992) Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive

ANSI A118.4	(1992) Latex-Portland Cement Mortar
ANSI A118.5	(1992) Chemical Resistant Furan Mortars and Grouts for Tile
ANSI A118.6	(1992) Ceramic Tile Grouts
ANSI A118.9	(1992) Cementitious Backer Units
ANSI A136.1	(1992) Organic Adhesives for Installation of Ceramic Tile
ANSI A137.1	(1988) Ceramic Tile

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 185	(1997) Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
ASTM C 33	(1997) Concrete Aggregates
ASTM C 144	(1997) Aggregate for Masonry Mortar
ASTM C 150	(1997) Portland Cement
ASTM C 206	(1984; R 1997) Finishing Hydrated Lime
ASTM C 207	(1991; R 1997) Hydrated Lime for Masonry Purposes
ASTM C 241	(1990) Abrasion Resistance of Stone Subjected to Foot Traffic
ASTM C 373	(1988; R 1994) Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products
ASTM C 648	(1998) Breaking Strength of Ceramic Tile
ASTM C 847	(1995) Metal Lath
ASTM C 1026	(1987; R 1996) Measuring the Resistance of Ceramic Tile to Freeze-Thaw Cycling
ASTM C 1027	(1984; R 1990) Determining Visible Abrasion Resistance of Glazed Ceramic Tile
ASTM C 1028	(1996) Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method
ASTM C 1178/C 1178M	(1996) Glass Mat Water-Resistant Gypsum

## Backing Panel

ASTM C 1288 (1995) Discrete Non-Asbestos Fiber-Cement  
Interior Substrate Sheets

ASTM C 1325 (1996) Fiber-Mat Reinforced Non-Asbestos  
Cement Interior Substrate Sheets

## MARBLE INSTITUTE OF AMERICA (MIA)

MIA Design Manual (1991) Design Manual IV Dimensional Stone

## NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 99 (1999) Health Care Facilities

## TILE COUNCIL OF AMERICA (TCA)

TCA Hdbk (1997) Handbook for Ceramic Tile Installation

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

## SD-03 Product Data

Tile Mortar, Grout, and Adhesive

Manufacturer's catalog data.

## SD-04 Samples

Tile; GA-BK GA-HQ, GA-DN, GA-CH.

Accessories; GA-BK, GA-HQ, GA-DN, GA-CH.

Marble Thresholds; GA-BK, GA-HQ, GA-DN, GA-CH.

Samples of sufficient size to show color range, pattern, type and joints.

## SD-07 Certificates

Tile Mortar, Grout, and Adhesive; GA-BK, GA-HQ, GA-DN, GA-CH

## SD-08 Manufacturer's Instructions

## Tile Mortar and Grout

Manufacturers preprinted installation and cleaning instructions.

Certificates indicating conformance with specified requirements. A master grade certificate shall be furnished for tile.

## 1.3 DELIVERY AND STORAGE

Materials shall be delivered to the project site in manufacturer's original unopened containers with seals unbroken and labels and hallmarks intact. Materials shall be kept dry, protected from weather, and stored under cover in accordance with manufacturer's instructions.

## 1.4 ENVIRONMENTAL REQUIREMENTS

Ceramic tile work shall not be performed unless the substrate and ambient temperature is at least 10 degrees C and rising. Temperature shall be maintained above 10 degrees C while the work is being performed and for at least 7 days after completion of the work. When temporary heaters are used they shall be vented to the outside to avoid carbon dioxide damage to new tilework.

## 1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a 1-year period shall be provided.

## PART 2 PRODUCTS

## 2.1 TILE

Tile shall be standard grade conforming to ANSI A137.1. Containers shall be grade sealed. Seals shall be marked to correspond with the marks on the signed master grade certificate. Tile shall be impact resistant with a minimum breaking strength for wall tile of 41 kg and 113 kg for floor tile in accordance with ASTM C 648. Water absorption shall be 0.50 maximum percent in accordance with ASTM C 373. Floor tile shall have a minimum coefficient of friction of 0.50 wet and dry in accordance with ASTM C 1028. Floor tile shall be Class III-Medium Heavy Traffic, durability classification as rated by the manufacturer when tested in accordance with ASTM C 1027 for abrasion resistance as related to foot traffic.

## 2.1.1 Glazed Porcelain Stone Tile

Pompeii Series manufactured by Crossville Ceramics Company or approved equal. Nominal facial dimensions shall be 300 mm x 300 mm. Nominal thickness shall be 11 mm.

## 2.1.2 Unglazed Quarry Tile

ANSI A 137.1, standard grade, square edges, with plain face. Olympia



Northwest 2000 series manufactured by Olympia Quarry Tile Company or approved equal. Nominal facial dimensions shall be 200 mm x 200 mm. Nominal thickness shall be 8 mm.

#### 2.1.3 Ceramic Floor Tile

Ceramic Mdsaics by American Olean or approved equal. Nominal facial dimensions shall be 50 mm x 50 mm.

#### 2.1.4 Glazed Wall Tile

Glazed wall tile and trim shall be cushion edged with gloss and matte glaze. Tile shall be 152 mm x 152 mm. Color shall be as specified in the INTERIOR FINISH SCHEDULE. Matte and gloss tile manufactured by American Olean Tile Company and Huntington Tile Company or approved equal.

#### 2.1.5 Trim Units

Provide matching trim units and accessories with tile work. Provide where indicated for a complete and finished installation. Internal corners shall be squared and external corners rounded using appropriate matching trim units.

### 2.2 WATER

Water shall be clean and potable.

### 2.3 MORTAR, GROUT AND ADHESIVE

#### 2.3.1 Mortar, Tile Setting

- a. Walls: Multi-purpose latex modified premixed mastic. Mastic shall be DAP2001 or approved equal.
- b. Floors: Latex-modified mortar thin-set. Mortar shall be C-Cure 905 or equal.

#### 2.3.2 Grout

- a. Walls: Unsanded latex-modified portland cement: ANSI A118.4, ANSI A 118.6, C-Cure or approved equal.
- b. Floors: Chemical-resistant, water-cleanable, tile-setting and grouting epoxy: ANSI A118.3.

#### 2.3.3 Sealants and Calkings

Provide sealants and calkings in joints as specified in Section 07920, "JOINT SEALANTS".

### 2.4 CEMENTITIOUS BACKER UNITS

ANSI A118.9; ASTM C 1325; ASTM C 1288: Concrete glass fiber reinforced, 13 mm thick prefabricated panel, consisting or aggregate portland cement

reinforced with vinyl-coated woven glass-fiber mesh embedded in both surfaces.

## 2.5 MARBLE THRESHOLDS

Marble thresholds shall be of size required by drawings or conditions. Marble shall be Group A as classified by MIA Design Manual. Marble shall have a fine sand-rubbed finish and shall be white in color as approved by the Contracting Officer. Marble abrasion shall be not less than 12.0 when tested in accordance with ASTM C 241.

## PART 3 EXECUTION

### 3.1 PREPARATORY WORK AND WORKMANSHIP

Surface to receive tile shall be inspected and shall conform to the requirements of ANSI A108.1A or ANSI A108.1B for surface conditions for the type setting bed specified and for workmanship. Variations of surface to be tiled shall fall within maximum values shown below:

TYPE	WALLS	FLOORS
Dry-Set Mortar	3 mm in 2.4 meters	3.0 mm in 3 meters
Latex portland cement mortar	3 mm in 2.4 meters	3.0 mm in 3 meters

### 3.2 GENERAL INSTALLATION REQUIREMENTS

Supply first-class workmanship in all tilework. Tile work shall not be started until roughing in for mechanical and electrical work has been completed and tested, and built-in items requiring membrane waterproofing have been installed and tested. Floor tile installation shall not be started in spaces requiring wall tile until after wall tile has been installed. Tile in colors and patterns indicated shall be applied in the area shown on the drawings. Tile shall be installed with the respective surfaces in true even planes to the elevations and grades shown. Special shapes shall be provided as required for sills, jambs, recesses, offsets, external corners, and other conditions to provide a complete and neatly finished installation. Tile bases and coves shall be solidly backed with mortar.

### 3.3 INSTALLATION OF FLOOR TILE

Floor tile shall be installed in accordance with TCA handbook, method F113-99. Latex-modified portland cement mortar shall be used to install tile directly over properly cured, plane, clean concrete slabs in accordance with ANSI A108.5.

#### 3.3.1 Workable Mortar Bed

Floor tile shall be installed over a workable mortar bed. Workable mortar bed materials and installation shall conform to ANSI A108.1A. Joints between quarry tile shall be between 6.35 mm and 9.53 mm in width and shall

be uniform in width.

### 3.3.2 Tile Grout

Grout materials and installation shall conform to ANSI A 178.6. Sand portland cement grout shall be used for Barracks wall tile. Chemical-resistant, water-cleanable, tile-setting and grouting epoxy shall be used for quarry tile in kitchens and porcelain tile in toilets. Follow grout manufacturer's recommendations as to grouting procedures.

### 3.3.3 Waterproofing

Shower pans are specified in Section 15400 "PLUMBING, GENERAL PURPOSE". Waterproofing under concrete fill shall conform to the requirements of Section 07123 "BITUMINOUS WATERPROOFING".

## 3.4 INSTALLATION OF MARBLE THRESHOLDS

Thresholds shall be installed where indicated in a manner similar to that of the ceramic tile floor. Thresholds shall be the full width of the opening. Head joints at ends shall not exceed 6 mm in width and shall be grouted full as specified for ceramic tile.

## 3.5 EXPANSION JOINTS

Joints shall be formed as indicated and sealed as specified in Section 07900 "JOINT SEALING". Determine location of all movement joints before stating tile work.

### 3.5.1 Walls

Expansion joints shall be provided at control joints in backing material. Wherever backing material changes, an expansion joint shall be installed to separate the different materials.

### 3.5.2 Floors

Expansion joints shall be provided over construction joints, control joints, and expansion joints in concrete slabs. Expansion joints shall be provided where tile abuts restraining surfaces such as perimeter walls, curbs and columns and at intervals of 7.2 to 10.8 m each way in large interior floor areas and 3.6 to 4.8 m each way in large exterior areas or areas exposed to direct sunlight or moisture. Expansion joints shall extend through setting-beds and fill.

## 3.6 CLEANING AND PROTECTING

Upon completion, tile surfaces shall be thoroughly cleaned in accordance with manufacturer's approved cleaning instructions. Acid shall not be used for cleaning glazed tile. Floor tile with resinous grout or with factory mixed grout shall be cleaned in accordance with instructions of the grout manufacturer. After the grout has set, tile wall surfaces shall be given a protective coat of a noncorrosive soap or other approved method of protection. Tiled floor areas shall be covered with building paper before

foot traffic is permitted over the finished tile floors. Prohibit all foot and wheel traffic from using newly tiled floors for at least 3 days, preferably. Board walkways shall be laid on tiled floors that are to be continuously used as passageways by workmen. Damaged or defective tiles shall be replaced.

-- End of Section --

## SECTION 09510

## ACOUSTICAL CEILINGS

**08/96**

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 423	Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM C 635	(1995) Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings
ASTM C 636	(1996) Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
ASTM E 84	Surface Burning Characteristics of Building Materials
ASTM E 119	(1995a) Fire Tests of Building Construction and Materials
ASTM E 413	Classification for Rating Sound Insulation
ASTM E 580	(1996) Application of Ceiling Suspension Systems for Acoustical Tile and Lay In Panels in Areas Requiring Seismic Restraint
ASTM E 1264	(1990) Standard Classification for Acoustical Ceiling Products
ASTM E 1414	(1991a) Standard Test for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
ASTM E 1477	Light Reflectance of Acoustical Materials by the Integrating Sphere Reflectometer

## COE TECHNICAL INSTRUCTIONS (TI)

TI 809-04

(1998) Seismic Design for Buildings

UNDERWRITERS LABORATORIES (UL)

UL Fire Resist Dir

(1997) Fire Resistance Directory (2 Vol)

## 1.2 GENERAL REQUIREMENTS

Acoustical treatment shall consist of sound controlling units and a ceiling suspension system. The unit size, texture, finish, and color shall be as specified. The Contractor has the option to substitute inch-pound (I-P) Recessed Light Fixtures (RLF) for metric RLF. If the Contractor opts to furnish I-P RLF, other ceiling elements like acoustical ceiling tiles, air diffusers, air registers and grills, shall also be I-P products. The Contractor shall coordinate the whole ceiling system with other details, like the location of access panels and ceiling penetrations, etc., shown on the drawings. If I-P products are used, the Contractor shall be responsible for all associated labor and materials and for the final assembly and performance of the specified work and products. The location and extent of acoustical treatment shall be as shown on the drawings. Reclamation of mineral fiber acoustical ceiling panels to be removed from the job site shall be in accordance with paragraph RECLAMATION PROCEDURES.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

### SD-02 Shop Drawings

Acoustical Ceiling System; GA-BK, GA-DN, GA-HQ, GA-CH

Drawings showing suspension system, method of anchoring and fastening, details, and reflected ceiling plan.

### SD-03 Product Data

Acoustical Ceiling System; GA-BK, GA-DN, GA-HQ, GA-CH

Manufacturer's descriptive data, catalog cuts, and installation instructions. Submittals which do not provide adequate data for the product evaluation will be rejected.

### SD-04 Samples

Acoustical Units; GA-BK, GA-DN, GA-HQ, GA-CH

Two samples of each type of acoustical unit and each type of suspension grid tee section showing texture, finish, and color.

#### SD-06 Test Reports

Ceiling Attenuation Class and Test; GA-KCGA-BK, GA-DN, GA-HQ, GA-CH

Reports by an independent testing laboratory attesting that acoustical ceiling systems meet specified sound transmission requirements. Data attesting to conformance of the proposed system to Underwriters Laboratories requirements for the fire endurance rating listed in UL Fire Resist Dir may be submitted in lieu of test reports.

#### SD-07 Certificates

Acoustical Units

Certificate attesting that the mineral based acoustical units furnished for the project contains recycled material and showing an estimated percent of such material.

### 1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Materials shall be carefully handled and stored in dry, watertight enclosures. Immediately before installation, acoustical units shall be stored for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

### 1.5 ENVIRONMENTAL REQUIREMENTS

Minimum requirements are a uniform temperature of not less than 16 degrees C nor more than 29 degrees C and a relative humidity of not more than 70 percent to be maintained before, during, and after installation of acoustical units. It is preferable that acoustical ceiling systems be installed only when temperature and humidity conditions closely approximate interior conditions to exist when building is occupied.

### 1.6 SCHEDULING

Interior finish work such as plastering, concrete and terrazzo work shall be complete and dry before installation. Mechanical, electrical, and other work above the ceiling line shall be completed and heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

### 1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided. Standard performance guarantee

or warranty shall contain an agreement to repair or replace acoustical panels that fail within the warranty period. Failures include, but are not limited to, sagging and warping of panels; rusting and manufacturers defects of grid system.

#### 1.8 EXTRA MATERIALS

Spare tiles of each color shall be furnished at the rate of 5 tiles for each 1000 tiles installed. Tiles shall be from the same lot as those installed.

### PART 2 PRODUCTS

#### 2.1 ACOUSTICAL UNITS

Acoustical units shall have flame spread rating of 25 or less, and smoke development rating of 50 or less pursuant to ASTM E 84. Acoustical units shall conform to ASTM E 1264, Class A, and the following requirements:

##### 2.1.1 Units for Narrow Reveal System ACT-1

Type: III (cast mineral fiber with painted finish). Type III acoustical units shall have a minimum recycled material content of 18 percent.

Minimum NRC: .50-.60 in accordance with ASTM C 423.

Pattern: E (fine textured).

Nominal size: 600 by 600 mm.

Edge detail: Narrow Reveal Edge.

Finish: Factory-applied standard finish, white.

Minimum LR coefficient: .77, in accordance with ASTM E 1477.

Minimum CAC: 30-34 in accordance with ASTM E 1414 and ASTM E 413.

Product: Celotex Nu-Tex or approved equal.

##### 2.1.2 Units for Narrow Reveal Edge ACT-2

Type III mineral fiber with painted finish acoustical units with a minimum recycled content of 18 percent. Units shall be manufactured to withstand temperatures to 40 C and relative humidity of 90% without visible sag.

Minimum NRC: .50-.60 in accordance with ASTM C 423.

Pattern: E

Nominal Size: Narrow Reveal Edge.

Edge Detail: Factory-applied standard finish in white.

Minimum LR Coefficient: .81 in accordance with ASTM E 1477.



Minimum CAC: 25-29 in accordance with ASTM E 1414 and ASTM E 413.

Product: Celotex Vantage 10 or approved equal.

## 2.2 SUSPENSION SYSTEM

Suspension system shall be standard exposed-grid narrow width flange, and shall conform to ASTM C 635 for intermediate-duty systems. Surfaces exposed to view shall be aluminum or steel with a factory-applied white baked-enamel finish. Wall molding shall have a flange of not less than 23 mm. Inside and outside corner caps Standard shall be provided. Suspended ceiling framing system shall have the capability to support the finished ceiling, light fixtures, air diffusers, and accessories, as shown. The suspension system shall have a maximum deflection of 1/360 of span length. Seismic details shall conform to the guidance in TI 809-04 and ASTM E 580.

## 2.3 HANGERS

Hangers shall be galvanized steel wire. Hangers and attachment shall support a minimum 1330 N ultimate vertical load without failure of supporting material or attachment.

## 2.4 ACCESS PANELS

Access panels shall match adjacent acoustical units and shall be designed and equipped with suitable framing and fastenings for removal and replacement without damage. Panel shall be not less than 300 by 300 mm or more than 300 by 600 mm. An identification plate of 0.8 mm thick aluminum, 19 mm in diameter, stamped with the letters "AP" and finished the same as the unit, shall be attached near one corner on the face of each access panel.

## 2.5 FINISHES

Acoustical units and suspension system members shall have manufacturer's standard textures, patterns and finishes as specified. Ceiling suspension system components shall be treated to inhibit corrosion.

## 2.6 COLORS AND PATTERNS

Colors and patterns for acoustical units and suspension system components shall be as specified in the INTERIOR FINISH SCHEDULE.

## 2.7 CEILING ATTENUATION CLASS AND TEST

Ceiling attenuation class (CAC) range of acoustical units, when required, shall be determined in accordance with ASTM E 1414. Test ceiling shall be continuous at the partition and shall be assembled in the suspension system in the same manner that the ceiling will be installed on the project. System shall be tested with all acoustical units installed.

# PART 3 EXECUTION

## 3.1 INSTALLATION

Acoustical work shall be provided complete with necessary fastenings, clips, and other accessories required for a complete installation. Mechanical fastenings shall not be exposed in the finished work. Hangers shall be laid out for each individual room or space. Hangers shall be placed to support framing around beams, ducts, columns, grilles, and other penetrations through ceilings. Main runners and carrying channels shall be kept clear of abutting walls and partitions. At least two main runners shall be provided for each ceiling span. Wherever required to bypass an object with the hanger wires, a subsuspension system shall be installed, so that all hanger wires will be plumb.

#### 3.1.1 Suspension System

Suspension system shall be installed in accordance with ASTM C 636 and as specified herein. There shall be no hanger wires or other loads suspended from underside of steel decking.

##### 3.1.1.1 Plumb Hangers

Hangers shall be plumb and shall not press against insulation covering ducts and pipes.

##### 3.1.1.2 Splayed Hangers

Where hangers must be splayed (sloped or slanted) around obstructions, the resulting horizontal force shall be offset by bracing, countersplaying, or other acceptable means.

#### 3.1.2 Wall Molding

Wall molding shall be provided where ceilings abut vertical surfaces. Wall molding shall be secured not more than 75 mm from ends of each length and not more than 400 mm on centers between end fastenings. Wall molding springs shall be provided at each acoustical unit in semi-exposed or concealed systems.

#### 3.1.3 Acoustical Units

Acoustical units shall be installed in accordance with the approved installation instructions of the manufacturer. Edges of acoustical units shall be in close contact with metal supports, with each other, and in true alignment. Acoustical units shall be arranged so that units less than one-half width are minimized. Units in exposed-grid system shall be held in place with manufacturer's standard hold-down clips, if units weigh less than 5 kg per square m or if required for fire resistance rating.

#### 3.2 CEILING ACCESS PANELS

Ceiling access panels shall be located directly under the items which require access.

#### 3.3 CLEANING

Following installation, dirty or discolored surfaces of acoustical units shall be cleaned and left free from defects. Units that are damaged or improperly installed shall be removed and new units provided as directed.

#### 3.4 RECLAMATION PROCEDURES

Ceiling tile, designated for recycling by the Contracting Officer, shall be neatly stacked on 1220 by 1220 mm pallets not higher than 1220 mm. Panels shall be completely dry. Pallets shall then be shrink wrapped and symmetrically stacked on top of each other without falling over. Disposal shall be in accordance with Section 02220 DEMOLITION.

-- End of Section --

## SECTION 09521

## ACOUSTICAL WALL SYSTEMS

04/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 423 (1990a) Sound absorption and Sound Absorption Coefficients by Reverberation Room Method

ASTM E 84 (116a) Surface Burning Characteristics of Building Materials

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

## SD-02 Shop Drawings

Acoustical Wall System; GA-HQ, GA-BK

Drawings showing method of anchoring and fastening, and panel layouts.

## SD-03 Product Data

Acoustical Wall System; GA-HQ, GA-BK

## SD-04 Samples

Acoustical Wall System; GA-HQ, GA-BK

Three 305 mm x 305 mm samples of each type of acoustical unit showing selected fabric coverings.

SD-08 Manufacturer's Instructions

Manufacturer's descriptive data, catalog cuts; GA-HQ, GA-BK

Installation Instructions

Maintenance

1.3 DESCRIPTION

Acoustical fabric wall system consisting of fabric stretched over an acoustical core of rigid polymer extrusions of varying profiles and sizes, as shown on the drawings and as specified.

1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original unopened containers with brand name and type clearly marked. Materials shall be carefully handled and stored in dry, watertight enclosures. Immediately before installation, acoustical units shall be stored for not less than 24 hours at the same temperature and relative humidity as the space where they will be installed in order to assure proper temperature and moisture acclimation.

1.5 ENVIRONMENTAL REQUIREMENTS

A uniform temperature of not less than 60 degrees for more than 85 degrees F and a relative humidity of not more than 70 percent shall be maintained before, during, and after installation of acoustical units.

1.6 SCHEDULING

Interior finish work such as plastering, concrete and terrazzo work shall be complete and dry before installation. Mechanical, electrical, and other work shall be completed and heating, ventilating, and air conditioning systems shall be installed and operating in order to maintain temperature and humidity requirements.

1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

1.8 QUALITY ASSURANCE

1.8.1 Fire Hazard Classification

All fabrics, cores and mounting devices shall pass ASTM E 84 Class A for flame spread and smoke.

Smoke Developed Index: 50

Flame Spread Index: 25

### 1.8.2 NRC

Minimum Noise Reduction Coefficient (NRC) of 0.80 with a 25 mm system and 3.0 PCF fiberglass core, per ASTM C 423.

## PART 2 PRODUCTS

### 2.1 MANUFACTURER

USG 1" 6 PCF acoustical molded fiberglass panel with resin edges, high traffic commercial grade fabric as specified on interior finish schedule, or approved equal. In classrooms, battalion headquarters, fabric covering must be as specified or approved by acoustical contractor. Fabric must be ordered and provided to panel manufacturer..

### 2.2 SYSTEM DESCRIPTION

Provide acoustical wall panels that are square edged and have a high impact resistance.

### 2.3 MATERIALS

#### 2.3.1 Fabrics

- a. Content: 92% Polyester/8% Polypropylene
- b. Width: 1676 mm
- c. Repeat: None
- d. Finish: Guildford Orizza 2818/093 Chambral
- e. Performance: Tensile (ASTM D 5034) 160 lbs. minimum warp, 75 lbs. minimum fill.  
  
Tear: (ASTM D 2261) 18 lbs. minimum warp and fill.  
Moisture Regain: (ASTM D 2654) 0.5% max.  
Colorfastness to light: (AATCC 16E) 40 hrs.  
Colorfastness to crocking: (AATCC 8), Class 4 min. dry, Class 4 min. wet.  
Flammability: (ASTM E 84) Class A.

#### 2.3.2 Core Material

Composite of 4.5-9.1 kg density molded fiberglass, 3.2 mm thick, bonded to 2.7-3.2 kg density rigid fiberglass board, with edges chemically hardened.

- a. Thickness: 54 mm
- b. NRC Grade: 1.0 minimum

#### 2.3.3 Acoustic Baffle Requirements

- a. NRC Grade: 0.8 minimum
- b. Thickness: 51 mm
- c. Core: 112 kg/.. fiberglass board

#### 2.3.4 Anchoring System

Standard fasteners recommended by the manufacturer to securely fasten extrusions to substrates involved.

### PART 3 EXECUTION

#### 3.1 DELIVERY STORAGE AND EXAMINATION

Examine the condition of the substrate and the conditions under which the work of this Section is to be performed. Notify the Contractor in writing of any unsatisfactory conditions. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner satisfactory to the Installer.

#### 3.2 INSTALLATION

General: Install materials in accordance with the manufacturer's instructions and complying with governing regulations, fire resistance rating requirements indicated and industry standards applicable to the work.

##### 3.2.1 Extrusions and Core

Install rigged polymer extrusions plumb and straight, flush, and in proper alignment. Install the core material required, continuous and flush, to the shoulder of the track and secure in place with recommended fasteners.

##### 3.2.2 Fabric

Cut the fabric from each roll maintaining sequence if drops and matching direction if weave for sequential and uniform installation. Stretch the fabric and secure so that it will be smooth, free of wrinkles and the wave straight and parallel to perimeter anchors, plumbs, and aligned horizontally and vertically. Gluing or stapling of fabric is not being accepted for this work.

#### 3.3 CLEANING AND PROTECTION

Clean exposed surfaces of acoustical wall system, complying with manufacture's instructions for cleaning and repair of minor finish damage. Remove and replace work which cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

-- End of Section --

## SECTION 09650

## RESILIENT FLOORING

07/96

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 2240	(1997) Rubber Property - Durometer Hardness
ASTM D 4078	(1992; R 1996) Water Emulsion Floor Polish
ASTM E 648	(1997) Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
ASTM E 662	(1995) Specific Optical Density of Smoke Generated by Solid Materials
ASTM F 1066	(1995a) Vinyl Composition Floor Tile
ASTM F 1344	(1993) Rubber Floor Tile

## 1.2 FIRE RESISTANCE REQUIREMENTS

Flooring in corridors and exits shall have a minimum average critical radiant flux of 0.45 watts per square centimeter when tested in accordance with ASTM E 648. The smoke density rating shall be less than 450 when tested in accordance with ASTM E 662.

## 1.3 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":



## SD-03 Product Data

Resilient Flooring and Accessories; GA-BK, GA-DN, GA-CH, GA-HQ

Manufacturer's descriptive data and installation instructions including cleaning and maintenance instructions.

## SD-04 Samples

Resilient Flooring and Accessories; GA-BK, GA-DN, GA-CH, GA-HQ

Three samples of each indicated color and type of flooring and base. Sample size shall be minimum 60 x 100 mm.

## SD-06 Test Reports

Resilient Flooring and Accessories; GA-BK, GA-DN, GA-CH, GA-HQ

Copies of test reports showing that representative product samples of the flooring proposed for use have been tested by an independent testing laboratory within the past three years or when formulation change occurred and conforms to the requirements specified.

## 1.4 DELIVERY AND STORAGE

Materials shall be delivered to the building site in original unopened containers bearing the manufacturer's name, project identification, and handling instructions. Materials shall be stored in a clean dry area with temperature maintained above 21 degrees C for 2 days prior to installation, and shall be stacked according to manufacturer's recommendations. Materials shall be protected from the direct flow of heat from hot-air registers, radiators and other heating fixtures and appliances.

## 1.5 ENVIRONMENTAL REQUIREMENTS

Areas to receive resilient flooring shall be maintained at a temperature above 21 degrees C and below 38 degrees C for 2 days before application, during application and 2 days after application. A minimum temperature of 13 degrees C shall be maintained thereafter.

## 1.6 SCHEDULING

Resilient flooring application shall be scheduled after the completion of other work which would damage the finished surface of the flooring.

## 1.7 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one year period shall be provided.

## 1.8 EXTRA MATERIALS

Extra flooring material of each color and pattern shall be furnished at the rate of 5 tiles for each 1000 tiles installed. Extra materials shall be

from the same lot as those installed. Extra base material composed of 6 m of each color shall be furnished.

## PART 2 PRODUCTS

### 2.1 VINYL-COMPOSITION TILE TYPE

Vinyl-composition tile shall conform to ASTM F 1066, Class 2, (through pattern tile), Composition 1, asbestos-free, and shall be either 300 mm square, or 150 mm by 300 mm, and 3.2 mm thick. Tile shall have the color and pattern uniformly distributed throughout the thickness of the tile. Flooring in any one continuous area shall be from the same lot and shall have the same shade and pattern.

### 2.2 RESILIENT BASE

Base shall be manufacturers standard 100% vulcanized SBR rubber, coved style (installed with resilient flooring). Base shall be 100 mm high and a minimum 3 mm thick. Preformed outside corners shall be furnished. Use flexible base to conform to irregularities in walls, partitions and floors.

### 2.3 TRANSITION STRIP

A 100% vulcanized SBR rubber transition strip tapered to meet abutting material shall be provided.

### 2.4 ADHESIVE

Adhesive for flooring and wall base shall be as recommended by the flooring manufacturer.

### 2.5 POLISH

Polish shall conform to ASTM D 4078.

### 2.6 CAULKING AND SEALANTS

Caulking and sealants shall be in accordance with Section 07900 JOINT SEALING.

### 2.7 MANUFACTURER'S COLOR AND TEXTURE

Color and texture shall be as indicated on the INTERIOR FINISH SCHEDULE.

## PART 3 EXECUTION

### 3.1 EXAMINATION/VERIFICATION OF CONDITIONS

The Contractor shall examine and verify that site conditions are in agreement with the design package and shall report all conditions that will prevent a proper installation. The Contractor shall not take any corrective action without written permission from the Government.

### 3.2 SURFACE PREPARATION

Flooring shall be in a smooth, true, level plane, except where indicated as sloped. Before any work under this section is begun, all defects such as rough or scaling concrete, low spots, high spots, and uneven surfaces shall have been corrected, and all damaged portions of concrete slabs shall have been repaired as recommended by the flooring manufacturer. Concrete curing compounds, other than the type that does not adversely affect adhesion, shall be entirely removed from the slabs. Paint, varnish, oils, release agents, sealers, waxers, and adhesives shall be removed, as recommended by the flooring manufacturer.

### 3.3 MOISTURE TEST

The suitability of the concrete subfloor for receiving the resilient flooring with regard to moisture content shall be determined by a moisture test as recommended by the flooring manufacturer.

### 3.4 INSTALLATION OF VINYL-COMPOSITION TILE

Tile flooring shall be installed with adhesive in accordance with the manufacturer's installation instructions. Tile lines and joints shall be kept square, symmetrical, tight, and even. Edge width shall vary as necessary to maintain full-size tiles in the field, but no edge tile shall be less than one-half the field tile size, except where irregular shaped rooms make it impossible. Flooring shall be cut to, and fitted around, all permanent fixtures, built-in furniture and cabinets, pipes, and outlets. Edge tile shall be cut, fitted, and scribed to walls and partitions after field flooring has been applied. Install flooring wall to wall before installation of floor-set cabinets, casework, furniture, moveable partitions, etc.

### 3.5 INSTALLATION OF RESILIENT BASE

Wall base shall be installed with adhesive in accordance with the manufacturer's written instructions. Base joints shall be tight and base shall be even with adjacent resilient flooring. Voids along the top edge of base at masonry walls shall be filled with caulk.

### 3.6 CLEANING

Immediately upon completion of installation of tile in a room or an area, flooring and adjacent surfaces shall be cleaned to remove all surplus adhesive. After installation, flooring shall be washed with a cleaning solution, rinsed thoroughly with clear cold water, and, except for raised pattern rubber flooring, rubber tile and sheet rubber flooring, rubber stair treads, and static control vinyl tile, given two coats of polish in accordance with manufacturers written instructions. After each polish coat, floors shall be buffed to an even luster with an electric polishing machine.

Raised pattern rubber flooring, rubber tile and sheet rubber flooring, rubber stair treads, and static control vinyl tile shall be cleaned and maintained as recommended by the manufacturer.

### 3.7 PROTECTION

From the time of laying until acceptance, flooring shall be protected from damage as recommended by the flooring manufacturer. Flooring which becomes damaged, loose, broken, or curled shall be removed and replaced.

-- End of Section --

## SECTION 09680

CARPET  
10/00

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

AATCC TM 16	(1998) Test Method: Colorfastness to Light
AATCC TM 134	(1996) Test Method: Electrostatic Propensity of Carpets
AATCC TM 165	(1999) Test Method: Colorfastness to Crocking: Carpets - AATCC Crockmeter Method

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 297	(1993; R 1998) Rubber Products - Chemical Analysis
ASTM D 418	(1993; R 1997) Pile Yarn Floor Covering Construction
ASTM D 1423	(1999) Twist in Yarns by the Direct-Counting Method
ASTM D 1667	(1997) Flexible Cellular Materials - Vinyl Chloride Polymers and Copolymers (Closed-Cell Foam)
ASTM D 3278	(1996e1) Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus
ASTM D 3676	(1996a) Rubber Cellular Cushion Used for Carpet or Rug Underlay
ASTM D 5252	(1998a) Practice for the Operation of the Hexapod Tumble Drum Tester
ASTM D 5417	(1999) Practice for Operation of the Vettermann Drum Tester
ASTM E 648	(1999) Critical Radiant Flux of

## Floor-Covering Systems Using a Radiant Heat Energy Source

### CARPET AND RUG INSTITUTE (CRI)

CRI 104 (1996) Commercial Carpet Installation Standard

### CODE OF FEDERAL REGULATIONS (CFR)

16 CFR 1630 Standard for the Surface Flammability of  
Carpet and Rugs (FF 1-70)

40 CFR 247 Comprehensive Procurement Guideline for  
Products Containing Recovered Materials

### GERMANY INSTITUTE FOR STANDARDIZATION (DIN)

DIN 54318 (1986) Machine-Made Textile Floor Coverings;  
Determination of Dimensional Changes Due to  
the Effects of Varied Water and Heat  
Conditions; Identical with ISO 2551 Edition  
1981

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

### SD-02 Shop Drawings

Installation; GA-HQ  
Molding; GA-HQ

Three copies of drawings indicating areas receiving carpet, carpet types, textures and patterns, direction of pile, location of seams, and locations of edge molding.

### SD-03 Product Data

Carpet; GA-HQ

Manufacturer's catalog data and printed documentation stating physical characteristics, durability, resistance to fading, and flame resistance characteristics for each type of carpet material and installation accessory.

Surface Preparation; GA-HQ  
Installation; GA-HQ

Three copies of the manufacturer's printed installation instructions for the carpet, including preparation of substrate, seaming techniques, and recommended adhesives and tapes.

Regulatory Requirements; GA-HQ

Three copies of report stating that carpet contains recycled materials and/or involvement in a recycling or reuse program. Report shall include percentage of recycled material.

#### SD-04 Samples

Carpet; GA-HQ  
Molding; GA-HQ

- a. Carpet: Two "Production Quality" samples 450 x 450 mm of each carpet proposed for use, showing quality, pattern, and color specified.
- b. Vinyl or Aluminum Moldings: Two pieces of each type at least 300 mm long.
- c. Special Treatment Materials: Two samples showing system and installation method.

#### SD-06 Test Reports

Moisture and Alkalinity Tests; GA-HQ

Three copies of test reports of moisture and alkalinity content of concrete slab stating date of test, person conducting the test, and the area tested.

#### SD-07 Certificates

Carpet; GA-HQ

Certificates of compliance from a laboratory accredited by the National Laboratory Accreditation Program of the National Institute of Standards and Technology attesting that each type of carpet and carpet with cushion material conforms to the standards specified.

#### SD-10 Operation and Maintenance Data

Carpet  
Cleaning and Protection

Three copies of carpet manufacturer's maintenance instructions describing recommended type of cleaning equipment and material, spotting and cleaning methods, and cleaning cycles.

### 1.3 REGULATORY REQUIREMENTS

Carpet and adhesives shall bear the Carpet and Rug Institute (CRI) Indoor Air Quality (IAQ) label or demonstrate compliance with testing criteria and frequencies through independent laboratory test results. Carpet type bearing the label will indicate that the carpet has been tested and meets the criteria of the CRI IAQ Carpet Testing Program, and minimizes the impact on indoor air quality. Contractor shall procure carpet in accordance with 40 CFR 247, shall submit a report stating that the carpet contains recycled materials and indicating the actual percentage of recycled material. Contractor shall, as much as possible, select material manufacturers that reduce pollutant and waste, recycle waste, reuse resources and scrap, and reclaim flooring materials instead of disposing into a landfill. Where possible, product shall be purchased locally to reduce emissions of fossil fuels from transporting.

### 1.4 DELIVERY AND STORAGE

Materials shall be delivered to the site in the manufacturer's original wrappings and packages clearly labeled with the manufacturer's name, brand name, size, dye lot number, and related information. Materials shall be stored in a clean, dry, well ventilated area, protected from damage and soiling, and shall be maintained at a temperature above 16 degrees C for 2 days prior to installation.

### 1.5 ENVIRONMENTAL REQUIREMENTS

Areas in which carpeting is to be installed shall be maintained at a temperature above 16 degrees C for 2 days before installation, during installation, and for 2 days after installation. A minimum temperature of 13 degrees C shall be maintained thereafter for the duration of the contract. Traffic or movement of furniture or equipment in carpeted area shall not be permitted for 24 hours after installation. Other work which would damage the carpet shall be completed prior to installation of carpet.

### 1.6 WARRANTY

Manufacturer's standard performance guarantees or warranties including minimum ten (10) year wear warranty, two (2) year material and workmanship and ten (10) year tuft bind and delamination.

### 1.7 EXTRA MATERIAL

Extra material from same dye lot consisting of uncut carpet tiles shall be provided for future maintenance. A minimum of 10 percent of total square meters of each carpet type, pattern, and color shall be provided.

## PART 2 PRODUCTS

### 2.1 CARPET TYPE A

Carpet shall be first quality; free of visual blemishes, streaks, poorly dyed areas, fuzzing of pile yarn, spots or stains, and other physical and



manufacturing defects. Carpet materials and treatments shall be reasonably nonallergenic and free of other recognized health hazards. All grade carpets shall have a static control construction which gives adequate durability and performance.

#### 2.1.1 Physical Characteristics

Carpet shall comply with the following:

- a. Recycle Efforts: Use of carpet cushions containing recovered materials or use of nylon carpet with backing containing recovered carpet or use of nylon fiber with recycled content 25 per cent (minimum).
- b. Carpet Construction: Tufted.
- c. Type: Modular tile 450 x 450 mm square with 0.15 percent growth/shrink rate in accordance with DIN 54318.
- d. Pile Type: Multilevel loop or Random sheared.
- e. Pile Fiber: Commercial 100% branded (federally registered trademark).
- f. Pile or Wire Height: Minimum 2.5 mm in accordance with ASTM D 418.
- g. Yarn Ply: Minimum 2 in accordance with ASTM D 1423.
- h. Gauge or Pitch: Minimum 30 mm/10cm in accordance with ASTM D 418.
- i. Stitches or Rows/Wires: Minimum 40 per 10cm.
- j. Finished Pile Yarn Weight: Minimum 678g per square meter. This does not include weight of backings. Weight shall be determined in accordance with ASTM D 418.
- k. Pile Density: Minimum Kilotex of 10.
- l. Dye Method: Solution dyed or Yarn (or Skein) dyed.
- m. Backing Materials: Primary backing materials shall be those customarily used and accepted by the trade for each type of carpet polypropylene. Secondary backing to suit project requirements shall be those customarily used and accepted by the trade for each type of carpet, except when a special unitary back designed for gluedown is provided.

#### 2.1.2 Performance Requirements

- a. ARR (Appearance Retention Rating): Carpet shall be tested and have the minimum 3.0-3.5 (Heavy) ARR when tested in accordance with either the ASTM D 5252 (Hexapod) or ASTM D 5417 (Vettermann) test methods using the number of cycles for short and long term tests as specified.

b. Static Control: Static control shall be provided to permanently control static buildup to less than 3.5 kV when tested at 20 percent relative humidity and 21 degrees C in accordance with AATCC TM 134.

c. Flammability and Critical Radiant Flux Requirements: Carpet shall comply with 16 CFR 1630. Carpet in corridors and exits shall have a minimum average critical radiant flux of 0.45 watts per square centimeter when tested in accordance with ASTM E 648.

d. Tuft Bind: Tuft bind force required to pull a tuft or loop free from carpet backing shall be a minimum 40 N average force for loop pile or 18 N average force for cut pile.

e. Colorfastness to Crocking: Dry and wet crocking shall comply with AATCC TM 165 and shall have a Class 4 minimum rating on the AATCC Color Transference Chart for all colors.

f. Colorfastness to Light: Colorfastness to light shall comply with AATCC TM 16, Test Option E "Water-Cooled Xenon-Arc Lamp, Continuous Light" and shall have a minimum 4 grey scale rating after 40 hours.

g. Delamination Strength: Delamination strength for tufted carpet with a secondary back shall be minimum of 440 N/m.

## 2.2 ADHESIVES AND CONCRETE PRIMER

Adhesives and concrete primers for installation of carpet shall be waterproof, nonflammable, meet local air-quality standards, and shall be as required by the carpet manufacturer. Seam adhesive shall be waterproof, nonflammable, and nonstaining as recommended by the carpet manufacturer. Release adhesive for modular tile carpet shall be as recommended by the carpet manufacturer. Adhesives flashpoint shall be minimum 60 degrees C in accordance with ASTM D 3278.

## 2.3 MOLDING

Aluminum molding shall be a hammered surface, pinless clamp-down type, designed for the type of carpet being installed. Finish shall be natural color anodized. Floor flange shall be a minimum 38 mm wide and face shall be a minimum 16 mm wide.

## 2.4 TAPE

Tape for seams shall be as recommended by the carpet manufacturer for the type of seam used in installation.

## 2.5 COLOR, TEXTURE, AND PATTERN

CPT1: Shaw Industries Duchene  
Square 59180/78330 Ivy  
Sculpture or approved equal.

CPT2: Shaw Industries Jeckyll Square  
59178/78330 Ivy Sculpture  
or approved equal.

CPT3: Shaw Industries Synthesis III  
59135/50332 Sage Brush or  
approved equal.

CPT4: Interface Flooring, The Loop  
1623102500/3510 Lakeshore  
or approved equal.

### PART 3 EXECUTION

#### 3.1 SURFACE PREPARATION

Carpet shall not be installed on surfaces that are unsuitable and will prevent a proper installation. Holes, cracks, depressions, or rough areas shall be repaired using material recommended by the carpet or adhesive manufacturer. Floor shall be free of any foreign materials and swept broom clean. Before beginning work, subfloor shall be tested with glue and carpet to determine "open time" and bond.

#### 3.2 MOISTURE AND ALKALINITY TESTS

Concrete slab shall be tested for moisture content and excessive alkalinity in accordance with CRI 104.

#### 3.3 PREPARATION OF CONCRETE SUBFLOOR

Installation of the carpeting shall not commence until concrete substrate is at least 90 days old. The concrete surfaces shall be prepared in accordance with instructions of the carpet manufacturer. Type of concrete sealer, when required, shall be compatible with the carpet.

#### 3.4 INSTALLATION

All work shall be performed by installers who are CFI certified (International Certified Floorcovering Installer Association), or manufacturer's approved installers. Installation shall be in accordance with the manufacturer's instructions and CRI 104. Edges of carpet meeting hard surface flooring shall be protected with molding; installation shall be in accordance with the molding manufacturer's instructions.

##### 3.4.1 Modular Tile Installation

Modular tiles shall be installed with permanent vinyl-compatible release adhesive and shall be snugly jointed together. Tiles shall be laid in the same direction an alternating pattern with accessibility to the subfloor where required.

#### 3.5 CLEANING AND PROTECTION

##### 3.5.1 Cleaning

After installation of the carpet, debris, scraps, and other foreign matter shall be removed. Soiled spots and adhesive shall be removed from the face of the carpet with appropriate spot remover. Protruding face yarn shall be cut off and removed. Carpet shall be vacuumed clean.

#### 3.5.2 Protection

The installed carpet shall be protected from soiling and damage with heavy, reinforced, nonstaining kraft paper, plywood, or hardboard sheets. Edges of kraft paper protection shall be lapped and secured to provide a continuous cover. Traffic shall be restricted for at least 45 hours. Protective covering shall be removed when directed by the Contracting Officer.

#### 3.6 REMNANTS

Remnants remaining from the installation, consisting of scrap pieces more than 600 mm in dimension with more than 0.6 square meters total, shall be provided. Non-retained scraps shall be removed from site and recycled appropriately.

-- End of Section --

## SECTION 09720

## WALLCOVERINGS

04/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 423	(1999a) Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
ASTM E 84	(1999) Surface Burning Characteristics of Building Materials
ASTM F 793	(1993; R 1998) Standard Classification of Wallcovering by Durability Characteristics

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

## SD-03 Product Data

Wallcoverings; GA-DN, GA-HQ  
Manufacturer's Instructions

Manufacturer's descriptive data, documentation stating physical characteristics, flame resistance, mildew and germicidal characteristics.

Installation; GA-DN, GA-HQ

Preprinted installation instructions for wallcovering and accessories.

Maintenance  
Clean-Up

Preprinted cleaning and maintenance instructions for wallcovering and accessories.

SD-04 Samples

Wallcoverings; GA-DN, GA-HQ

Three samples of each indicated type, pattern, and color of wallcovering. Samples of wall covering shall be minimum 125 x 175 mm and of sufficient size to show pattern repeat. Three samples of each indicated type corner guard and wainscot cap.

SD-07 Certificates

Wallcoverings; GA-DN, GA-HQ

Manufacturer's statement attesting that the product furnished meets or exceeds specification requirements. The statement must; be dated after the award of the contract, state Contractor's name and address, name the project and location, and list the requirements being certified.

1.3 DELIVERY AND STORAGE

Materials shall be delivered to the site in manufacturers original unopened containers labeled with manufacturers name, pattern, texture, size and related information. Materials shall be stored in accordance with the manufacturer's instructions in a clean dry ventilated area with temperature maintained above 16 degrees C for two days prior to installation.

1.4 ENVIRONMENTAL REQUIREMENTS

Areas to receive wallcovering shall be maintained at a temperature above 16 degrees C for 7 days before, during, and 7 days after application.

1.5 WARRANTY

Manufacturer's standard performance guarantees or warranties that extend beyond a one-year period shall be provided.

1.6 EXTRA MATERIALS

Extra material from the same dye lot consisting of 0.5 m of full-width wallcovering for each 30 linear meters of wallcovering installed shall be provided for maintenance.

PART 2 PRODUCTS

2.1 WALLCOVERINGS

Wallcoverings shall be material designed specifically for the specified use.

The wallcovering shall contain a non-mercury based mildewcide. The wallcovering shall be type made without the use of cadmium based stabilizers. Wallcovering shall have a Class A flame spread rating of 0-25 and smoke development rating of 0-50 when tested in accordance with ASTM E 84.

#### 2.1.1 Vinyl Wallcovering Type VWC1 and VWC2

Vinyl wallcovering shall be a vinyl coated woven or nonwoven fabric with germicidal additives and shall conform to ASTM F 793, Category IV, Type I, (0.270 to 0.440 kg) V Type II, (0.445 to 0.815 kg) total weight per square meter and width of 1370 mm.

#### 2.1.2 Fabric Wallcovering

All fabric wallcovering shall be heavy duty Type II fabric. Fabric shall be Class A fire rated in accordance with ASTM E 84 tunnel test and conform with UBC 802. Fabric wallcovering shall be a woven fabric with paper or acrylic backing.

##### 2.1.2.1 Fabric Wallcovering Type FWC1

FWC1 shall be 100% polyolefin with a Teflon finish and acrylic backing.

##### 2.1.2.2 Fabric Wallcovering Type FWC2

FWC2 shall be 58% polyester, 42% polyolefin with a Teflon finish and acrylic backing.

##### 2.1.2.3 Fabric Wallcovering Type FP-1 (Barracks)

FP-1 shall be 100% polyolefin with a Teflon finish and acrylic backing. FP-1 shall be used to wrap panels for the display case.

#### 2.1.3 Acoustical Wallcovering Type AWC1

Acoustical wallcovering shall be unbacked, 92% polyester, 8% polypropylene and rated Class A in accordance with ASTM E 84. AWC1 shall be ordered COM to be wrapped around acoustical wall panels refer to Section 09521.

#### 2.1.4 Sisal Wallcovering Type SWC1

SWC1 shall be 100% natural sisal fibers manufactured in a boucle weave, with no backing. Minimum total weight shall be 155g/930c.. . Sisal wallcovering shall have a minimum NRC of .15. SWC1 shall be Class A fire rated in accordance with ASTM E 84.

#### 2.2 CORNER GUARDS

Corner guards where applicable, shall be 2 mm thick and shall cover 19 mm each side of corner at right angles. Corner guards shall be clear polycarbonate from the same lot and color.

#### 2.3 WAINSCOT CAP

Wainscot cap where applicable, shall be satin-finished extruded aluminum about 19 mm high, feathered at bottom edge, with an approximate 5 mm exposed face on top edge, and grooved to receive the covering.

#### 2.4 PRIMER AND ADHESIVE

Primer and adhesive shall be of a type recommended by the wallcovering manufacturer and shall contain a non-mercury based mildewcide. Adhesive shall be strippable type. Adhesive to install cap shall be of a type recommended by the manufacturer of the wainscot cap.

#### 2.5 COLOR, TEXTURE, AND PATTERN

Color, texture, and pattern shall be in accordance with Section 09915 COLOR SCHEDULE.

VWC1: Colour and Design Laurel leaf/CD2-LLT-04 Taupe or approved equal.

VWC2: Maharam Honorweave 395510/005 Bronze or approved equal.

VWC3: RJF International Walltalker Nu.vu.rite, Matte White refer to Section 10100 Visual Communication Specialties.

VWC1: Maharam Tek-Wall Index 395770, 005 Olivine or approved equal.

VWC2: Maharam Tek-Wall Asia 305803, 006 Everglade or approved equal.

FP-1: Maharam Tek-Wall Saga 303407, 003 Pod or approved equal.

AWP1: Guilford of Maine Orissa 2818, 043 Chambal or approved equal.

SWP1: Design Materials No-Flame Sisal Wallcovering, 8000 or approved equal.

### PART 3 EXECUTION

#### 3.1 EXAMINATION

Contractor shall inspect all areas and conditions under which wallcoverings are to be installed. Contractor shall notify in writing of any conditions detrimental to the proper and timely completion of the installation. Work will proceed only when conditions have been corrected and accepted by the installer.

#### 3.2 SURFACE PREPARATION

Wallcovering shall not be applied to surfaces that are rough, that contain stains that will bleed through the wallcovering, or that are otherwise unsuitable for proper installation. Cracks and holes shall be filled and rough spots shall be sanded smooth. Surfaces to receive wallcovering shall be thoroughly dry. Plaster surfaces shall age at least 30 days prior to installation of vinyl wallcoverings. Interior surfaces of exterior masonry walls shall be sealed to prevent moisture penetration, then primed with a



wallcovering primer in accordance with the manufacturer's instructions. Moisture content of plaster, concrete, and masonry shall be tested with an electric moisture meter and reading shall be not more than 5 percent. Masonry walls shall have flush joints. Concrete and masonry walls shall be coated with a thin coat of joint compound or cement plaster as a substrate preparation. To promote adequate adhesion of wall lining over masonry walls, the walls shall be primed as recommended by the wall lining manufacturer. Surface of walls shall be primed as required by manufacturer's instructions to permit ultimate removal of wallcovering from the wall surface. Primer shall be allowed to completely dry before adhesive application.

### 3.3 INSTALLATION

#### 3.3.1 Wall Lining

Wall lining shall be installed over masonry walls that are to receive wallcovering. Lining shall be installed in accordance with the manufacturer's installation instructions. Lining shall be installed perpendicular to wallcovering to prevent overlapping of seams between lining and wallcovering.

#### 3.3.2 Vinyl and Fabric Wallcovering

Wallcovering shall be installed in accordance with the manufacturer's installation instructions. Glue and adhesive spillage shall be immediately removed from wallcovering face and seams with a remover recommended by the manufacturer. After the installation is complete, the fabric wallcovering shall be vacuumed with a ceiling to floor motion.

#### 3.3.3 Corner Guards and Wainscot Cap

Corner guards and wainscot cap shall be installed where shown on the drawings on all exposed corners and in accordance with the manufacturer's printed instructions. Corner guards shall run from top of base to wainscot cap ceiling in a continuous length.

### 3.4 CLEAN-UP

Upon completion of the work, wallcovering shall be left clean and free of dirt or soiling. Surplus materials, rubbish, and debris resulting from the wallcovering installation shall be removed and area shall be left clean.

-- End of Section --

## SECTION 09900

## PAINTING, GENERAL

07/92

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH Limit Values	(1999) Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices
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## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 150	(1998a) Portland Cement
ASTM D 3273	(1994) Resistance to Growth of Mold on the Surface of Interior Coating in an Environmental Chamber
ASTM D 3274	(1995) Evaluating Degree of Surface Disfigurement of Paint Films by Microbial (Fungal or Algal) Growth or Soil and Dirt Accumulation
ASTM D 4214	(1998) Evaluating Degree of Chalking of Exterior Paint Films
ASTM D 4258	(1999) Surface Cleaning Concrete for Coating

## COMMERCIAL ITEM DESCRIPTIONS (CID)

CID A-A-1500	(Rev A; Notice 1) Sealer, Surface (Latex Block Filler)
CID A-A-1546	(Rev A; Canc. Notice 1)) Rubbing Varnish
CID A-A-1632	(Basic) Varnish, Asphalt
CID A-A-1788	(Canc. Notice 1)) Varnish, Oil; Interior
CID A-A-2246	(Rev B) Paint, Latex
CID A-A-2247	(Basic) Paint, Latex (Semigloss, Interior)

CID A-A-2248	(Basic) Paint, Latex, (Flat, Interior)
CID A-A-2335	(Canc. Notice 1) Sealer, Surface (Varnish Type, Wood and Cork Floors)
CID A-A-2336	(Rev A) Primer Coating (Alkyd, Exterior Wood, White and Tints)
CID A-A-2339	(Canc. Notice 1) Stain (Wood, Solvent-Dye Type)
CID A-A-2542	Sealer, Terrazzo and Concrete Floors, Waterbased
CID A-A-2834	(Basic) Urethane, Waterborne (Low VOC, Clear)
CID A-A-2867	Coating, Polyurethane, Single Component Moisture Cure, Alipathic
CID A-A-2962	(Rev A) Enamel, Alkyd (Metric)
CID A-A-2994	Primer Coating, Interior, for Walls and Wood

FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1	(Rev J) Obstruction Marking and Lighting
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FEDERAL SPECIFICATIONS (FS)

FS TT-C-542	(Rev E) Coating, Polyurethane, Oil-Free, Moisture Curing
FS TT-C-555	(Rev B; Am 1) Coating, Textured (for Interior and Exterior Masonry Surfaces)
FS TT-E-2784	(Rev A) Enamel (Acrylic-Emulsion, Exterior Gloss and Semigloss) (Metric)
FS TT-P-28	(Rev G; Notice 1) Paint, Aluminum, Heat Resisting (1200 Degrees F.)
FS TT-S-708	(Rev A; Am 2; Notice 1) Stain, Oil; Semi-Transparent, Wood, Exterior
FS TT-S-001992	(Basic; Notice 1) Stain, Latex, Exterior for Wood Surfaces

MAPLE FLOORING MANUFACTURERS ASSOCIATION (MFMA)

MFMA-03	(1997) Floor Sealer and Finish List and Specifications for Heavy Duty and Gymnasium Sealers and Finishes for Maple, Beech and Birch Floors: MFMA Floor Finish List Number 16
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THE SOCIETY FOR PROTECTIVE COATINGS (SSPC)

SSPC Paint 5	(1995) Zinc Dust, Zinc Oxide and Phenolic Varnish Paint
SSPC Paint 18	(1991) Chlorinated Rubber Intermediate Coat Paint
SSPC Paint 20	(1991) Zinc-Rich Primers (Type I - "Inorganic" and Type II - "Organic")
SSPC Paint 23	(1991) Latex Primer for Steel surfaces
SSPC Paint 25	(1991) Red Iron Oxide, Zinc Oxide, Raw Linseed Oil and Alkyd Primer (Without Lead and Chromate Pigments)
SSPC SP 1	(1982) Solvent Cleaning
SSPC SP 2	(1995) Hand Tool Cleaning
SSPC SP 3	(1995) Power Tool Cleaning
SSPC SP 6/NACE 3	(1994) Commercial Blast Cleaning
SSPC SP 7/NACE 4	(1994) Brush-Off Blast Cleaning

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

### SD-03 Product Data

#### Paint

The names, quantity represented, and intended use for the proprietary brands of materials proposed to be substituted for the specified materials when the required quantity of a particular batch is 200 L or less.

### SD-04 Samples

Moisture-Curing Polyurethane; GA-BK, GA-CH, GA-DN, GA-HQ

A complete moisture-curing polyurethane system applied to a panel of the same material as that on which the coating will be applied in the work and

for each color specified. The sample panels will be used for quality control in applying the system.

Paint; GA-BK, GA-CH, GA-DN, GA-HQ.

While the material is at the site or source of supply, and at a time agreeable to the Contractor and the Contracting Officer, a 1 liter sample of each color and batch, except for quantities of 200 liters or less, shall be taken by random selection from the sealed containers by the Contractor in the presence of a representative of the Contracting Officer. The contents of the containers to be sampled shall be thoroughly mixed to ensure that the sample is representative. Samples shall be identified by designated name, specification number, manufacturer name and address, batch number, project contract number, intended use, and quantity involved.

#### SD-06 Test Reports

Paint; GA-BK, GA-CH, GA-DN, GA-HQ.

A statement as to the quantity represented and the intended use, plus the following test report for batches in excess of 200L:

- a. A test report showing that the proposed batch to be used meets specified requirements:
- b. A test report showing that a previous batch of the same formulation as the batch to be used met specified requirements, plus, on the proposed batch to be used, a report of test results for properties of weight per liter, viscosity, fineness of grind, drying time, color, and gloss.

#### SD-07 Certificates

Lead; GA-BK, GA-CH, GA-DN, GA-HQ Mildewcide and Insecticide; GA-BK, GA-CH, GA-DN, GA-HQ Volatile Organic Compound (VOC) Content; GA-BK, GA-CH, GA-DN, GA-HQ

Certificate stating that paints for interior use contain no mercurial mildewcide or insecticide. Certificate stating that paints proposed for use contain not more than 0.06 percent lead by weight of the total nonvolatile. Certificate stating that paints proposed for use meet Federal VOC regulations and those of the of the local Air Pollution Control Districts having jurisdiction over the geographical area in which the project is located.

#### SD-08 Manufacturer's Instructions

Mixing and Thinning; GA-BK, GA-CH, GA-DN, GA-HQ

Application; GA-BK, GA-CH, GA-DN, GA-HQ

Manufacturer's current printed product description, material safety data sheets (MSDS) and technical data sheets for each coating system. Detailed mixing, thinning and application instructions, minimum and maximum

application temperature, and curing and drying times between coats for epoxy, moisture-curing polyurethane, and liquid glaze coatings. Detailed application instructions for textured coatings shall be provided.

### 1.3 PACKAGING, LABELING, AND STORING

Paints shall be in sealed containers that legibly show the designated name, formula or specification number, batch number, color, quantity, date of manufacture, manufacturer's formulation number, manufacturer's directions including any warnings and special precautions, and name of manufacturer. Pigmented paints shall be furnished in containers not larger than 20 liters.

Paints and thinner shall be stored in accordance with the manufacturer's written directions and as a minimum stored off the ground, under cover, with sufficient ventilation to prevent the buildup of flammable vapors and at temperatures between 4 and 35 degrees C. Paints shall be stored on the project site or segregated at the source of supply sufficiently in advance of need to allow 30 days for testing.

### 1.4 APPROVAL OF MATERIALS

When samples are tested, approval of materials will be based on tests of the samples; otherwise, materials will be approved based on test reports furnished with them. If materials are approved based on test reports furnished, samples will be retained by the Government for testing should the materials appear defective during or after application. In addition to any other remedies under the contract the cost of retesting defective materials will be at the Contractor's expense.

### 1.5 ENVIRONMENTAL CONDITIONS

Unless otherwise recommended by the paint manufacturer, the ambient temperature shall be between 7 and 35 degrees C when applying coatings other than water-thinned, epoxy, and moisture-curing polyurethane coatings. Water-thinned coatings shall be applied only when ambient temperature is between 10 and 32 degrees C. Epoxy, and moisture-curing polyurethane coatings shall be applied only within the minimum and maximum temperatures recommended by the coating manufacturer. Moisture-curing polyurethane shall not be applied when the relative humidity is below 30 percent.

### 1.6 SAFETY AND HEALTH

Work shall comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis as specified in the CONTRACT CLAUSES. The Activity Hazard Analysis shall include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

#### 1.6.1 Worker Exposures

Exposure of workers to hazardous chemical substances shall not exceed limits established by ACGIH Limit Values, or as required by a more stringent applicable regulation.

#### 1.6.2 Toxic Compounds

Toxic products having ineffective physiological warning properties, such as no or low odor or irritation levels, shall not be used unless approved by the Contracting Officer.

#### 1.6.3 Training

Workers having access to an affected work area shall be informed of the contents of the applicable material data safety sheets (MDSS) and shall be informed of potential health and safety hazard and protective controls associated with materials used on the project. An affected work area is one which may receive mists and odors from the painting operations. Workers involved in preparation, painting and clean-up shall be trained in the safe handling and application, and the exposure limit, for each material which the worker will use in the project. Personnel having a need to use respirators and masks shall be instructed in the use and maintenance of such equipment.

#### 1.6.4 Coordination

Work shall be coordinated to minimize exposure of building occupants, other Contractor personnel, and visitors to mists and odors from preparation, painting and clean-up operations.

### PART 2 PRODUCTS

#### 2.1 PAINT

The term "paint" as used herein includes emulsions, enamels, paints, stains, varnishes, sealers, cement-emulsion filler, and other coatings, whether used as prime, intermediate, or finish coat. Paint shall conform to the requirements listed in the painting schedules at the end of this section, except when the required amount of a material of a particular batch is 200 liters or less, an approved first-line proprietary paint material with similar intended formulation, usage and color to that specified may be used. Additional requirements are as follows:

##### 2.1.1 Colors and Tints

Colors shall be as selected from manufacturer's standard colors, as indicated. Manufacturer's standard color is for identification of color only. Tinting of epoxy and urethane paints shall be done by the manufacturer. Stains shall conform in shade to manufacturer's standard color. The color of the undercoats shall vary slightly from the color of the next coat.

##### 2.1.2 Mildewcide and Insecticide

Paint specified for all coats applied to fabrics and vapor barrier jackets over insulation shall contain a mildewcide that will not adversely affect the color, texture, or durability of the coating. The mildewcide shall be incorporated into the paint by the manufacturer and shall attain a surface disfigurement rating of 8 or greater when tested in accordance with ASTM D

3273 and evaluated in accordance with ASTM D 3274. Mercurial mildewcide shall not be used in interior paint. Insecticides shall not be used in paint.

#### 2.1.3 Lead

Paints containing lead in excess of 0.06 percent by weight of the total nonvolatile content (calculated as lead metal) shall not be used.

#### 2.1.4 Chromium

Paints containing zinc chromate or strontium chromate pigments shall not be used.

#### 2.1.5 Volatile Organic Compound (VOC) Content

Paints shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards and shall conform to the restrictions of the local air pollution control authority.

### PART 3 EXECUTION

#### 3.1 PROTECTION OF AREAS NOT TO BE PAINTED

Items not to be painted which are in contact with or adjacent to painted surfaces shall be removed or protected prior to surface preparation and painting operations. Items removed prior to painting shall be replaced when painting is completed. Following completion of painting, workmen skilled in the trades involved shall reinstall removed items. Surfaces contaminated by coating materials shall be restored to original condition.

#### 3.2 SURFACE PREPARATION

Surfaces to be painted shall be clean and free of foreign matter before application of paint or surface treatments. Oil and grease shall be removed prior to mechanical cleaning. Cleaning shall be programmed so that dust and other contaminants will not fall on wet, newly painted surfaces. Exposed ferrous metals such as nail heads on or in contact with surfaces to be painted with water-thinned paints, shall be spot-primed with a suitable corrosion-inhibitive primer capable of preventing flash rusting and compatible with the coating specified for the adjacent areas.

##### 3.2.1 Concrete, Stucco and Masonry Surfaces

Concrete, stucco and masonry surfaces shall be allowed to dry at least 30 days before painting, except concrete slab on grade which shall be allowed to cure 90 days before painting. Surfaces shall be cleaned in accordance with ASTM D 4258. Glaze, efflorescence, laitance, dirt, grease, oil, asphalt, surface deposits of free iron and other foreign matter shall be removed prior to painting. Surfaces to receive polyurethane or epoxy coatings shall be acid-etched or mechanically abraded as specified by the coating manufacturer, rinsed with water, allowed to dry, and treated with the manufacturer's recommended conditioner prior to application of the first coat.



### 3.2.2 Ferrous Surfaces

Ferrous surfaces including those that have been shop-coated, shall be solvent-cleaned or detergent-washed in accordance with SSPC SP 1. Surfaces that contain loose rust, loose mill scale, and other foreign substances shall be cleaned mechanically with hand tools according to SSPC SP 2, power tools according to SSPC SP 3 or by sandblasting according to SSPC SP 7/NACE 4.

Shop-coated ferrous surfaces shall be protected from corrosion by treating and touching up corroded areas immediately upon detection.

### 3.2.3 Nonferrous Metallic Surfaces

Galvanized, aluminum and aluminum-alloy, lead, copper, and other nonferrous metal surfaces shall be solvent-cleaned or detergent-washed in accordance with SSPC SP 1.

### 3.2.4 Gypsum Board Surfaces

Gypsum board surfaces shall be dry and shall have all loose dirt and dust removed by brushing with a soft brush, rubbing with a cloth, or vacuum-cleaning prior to application of the first-coat material. A damp cloth or sponge may be used if paint will be water-based.

### 3.2.5 Mastic-Type Surfaces

Mastic-type surfaces shall be prepared by removing foreign material.

### 3.2.6 Wood Surfaces

Wood surfaces shall be cleaned of foreign matter. Moisture content of the wood shall not exceed 12 percent as measured by a moisture meter, unless otherwise authorized. Wood surfaces adjacent to surfaces to receive water-thinned paints shall be primed and/or touched up before applying water-thinned paints. Small, dry seasoned knots shall be scraped, cleaned, and given a thin coat of commercial knot sealer, before application of the priming coat. Pitch on large, open, unseasoned knots and all other beads or streaks of pitch shall be scraped off, or, if it is still soft, removed with mineral spirits or turpentine, and the resinous area shall be thinly coated with knot sealer. Finishing nails shall be set, and all holes and surface imperfections shall be primed. After priming, holes and imperfections in finish surfaces shall be filled with putty or plastic wood filler, colored to match the finish coat if natural finish is required, allowed to dry, and sanded smooth. Putty or wood filler shall be compatible with subsequent coatings.

#### 3.2.6.1 Interior Wood Stain

Interior wood surfaces to receive stain shall be sanded. Oak and other open-grain wood to receive stain shall be given a coat of wood filler not less than 8 hours before the application of stain; excess filler shall be removed and the surface sanded smooth.

### 3.3 MIXING AND THINNING

When thinning is approved as necessary to suit surface, temperature, weather conditions, or application methods, paints may be thinned in accordance with the manufacturer's directions. When thinning is allowed, paints shall be thinned immediately prior to application with not more than 0.125 L of suitable thinner per liter. The use of thinner shall not relieve the Contractor from obtaining complete hiding, full film thickness, or required gloss. Thinning shall not cause the paint to exceed limits on volatile organic compounds. Paints of different manufacturers shall not be mixed.

#### 3.3.1 Cement-Emulsion Filler Coat

Cement and aggregate shall be dry-mixed so that uniform distribution and intermixing are obtained. Mixing liquid and one-half of the total amount of water shall be premixed and added gradually to the white portland cement and aggregate with constant stirring until a thick, smooth material is obtained.

Emulsion paint shall then be added to the mixture and stirred until uniformity is obtained. The blend shall have a thick, creamy consistency. The remainder of the water shall be added if necessary to obtain a material with adequate application properties. Blending resin emulsion or emulsion paint with any other component shall be done with caution; too rapid an agitation will cause air entrapment and foaming.

#### 3.3.2 Two-Component Systems

Two-component systems shall be mixed in accordance with manufacturer's instructions. Any thinning of the first coat to ensure proper penetration and sealing shall be as recommended by the manufacturer for each type of substrate.

### 3.4 APPLICATION

Painting practices shall comply with applicable federal, state and local laws enacted to insure compliance with Federal Clean Air Standards. Unless otherwise specified or recommended by the paint manufacturer, paint may be applied by brush, roller, or spray. At the time of application, paint shall show no signs of deterioration. Uniform suspension of pigments shall be maintained during application. Each coat of paint shall be applied so dry film shall be of uniform thickness and free from runs, drops, ridges, waves, pinholes or other voids, laps, brush marks, and variations in color, texture, and finish. Hiding shall be complete. Rollers for applying paints and enamels shall be of a type designed for the coating to be applied and the surface to be coated. Special attention shall be given to insure that all edges, corners, crevices, welds, and rivets receive a film thickness equal to that of adjacent painted surfaces. Paints, except water-thinned types, shall be applied only to surfaces that are completely free of moisture as determined by sight or touch.

#### 3.4.1 Ventilation

Affected areas shall be ventilated during paint application so that workers exposure to chemical substances shall not exceed limits as established by ACGIH Limit Values, or as required by a more stringent applicable regulation. Interior work zones having a volume of 280 cubic meters or less

shall be ventilated at a minimum of 2 air exchanges per hour. Ventilation in larger work zones shall be maintained by means of mechanical exhaust. Solvent vapors shall be exhausted outdoors, away from air intakes and workers. Return air inlets in the work zone shall be temporarily sealed before start of work until the coatings have dried.

#### 3.4.2 Respirators

Operators and personnel in the vicinity of operating paint sprayers shall wear respirators.

#### 3.4.3 First Coat

The first coat on plaster, gypsum wallboard, and other surfaces shall include repeated touching up of suction spots or overall application of primer or sealer to produce uniform color and gloss. Excess sealer shall be wiped off after each application. The first coat on both faces of wood doors shall be applied at essentially the same time. Glazed doors and sashes shall be given the specified coating system within 3 weeks of the time they are glazed, but not before the glazing material has set; paint shall overlay glass about 1.78 mm all around. Each varnish coat shall be sanded lightly prior to application of subsequent coats.

#### 3.4.4 Timing

Surfaces that have been cleaned, pretreated, and otherwise prepared for painting shall be given a coat of the specified first coat as soon as practical after such pretreatment has been completed, but prior to any deterioration of the prepared surface. Sufficient time shall elapse between successive coats to permit proper drying. This period shall be modified as necessary to suit weather conditions. Oil-based or oleoresinous solvent-type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause the undercoat to lift or lose adhesion. Manufacturer's instructions for application, curing and drying time between coats of two-component systems shall be followed.

#### 3.4.5 Stains

Stain shall be applied at the rate specified in the manufacturer's printed directions. Oil-type stain shall be applied by brushing with the grain for the full length of the board or course of siding.

#### 3.4.6 Fillers

Concrete and masonry surface voids shall be filled; however, surface irregularities need not be completely filled. The dried filler shall be uniform and free of pinholes. Filler shall not be applied over caulking compound.

##### 3.4.6.1 Cement-Emulsion Filler

Immediately before filler application, surfaces shall be dampened uniformly

and thoroughly, with no free surface water visible, by several applications of potable water with a fog spray, allowing time between the sprayings for water to be absorbed. Cement-emulsion filler shall be scrubbed into the surface vigorously with a stiff-bristled brush having tampico or palmyra bristles not longer than 63 mm. At least 24 hours shall elapse before applying exterior emulsion paint over cement-emulsion filler. When the ambient temperature is over 29 degrees C, cement-emulsion filler surfaces shall be dampened lightly with a fog spray of potable water immediately prior to application of the subsequent paint coat.

#### 3.4.6.2 Latex Filler

Latex filler, CID A-A-1500, shall be applied according to the manufacturer's instructions. Surface voids shall be filled and excess filler shall be removed from the surface with a rubber squeegee. The filler shall be allowed to dry the length of time specified by the manufacturer prior to applying successive coats of paint.

#### 3.4.7 Textured Coating

Application of textured coating, FS TT-C-555, shall be as specified in the manufacturer's printed directions. Texture coating on gypsum board shall be Knockdown Finish #2-TWF-1.

#### 3.4.8 Ferrous-Metal Primer

Primer for ferrous-metal shall be applied to ferrous surfaces to receive paint other than asphalt varnish prior to deterioration of the prepared surface. The semitransparent film applied to some pipes and tubing at the mill is not to be considered a shop coat, but shall be overcoated with the specified ferrous-metal primer prior to application of finish coats.

### 3.5 PIPE COLOR CODE MARKING

Pipes in exposed areas and in accessible pipe spaces shall be provided with color band and titles adjacent to all valves, except those provided at plumbing fixtures, at not more than 12 meter spacing on straight pipe runs, adjacent to change in direction, and on both sides where pipes pass through walls or floors. Color code marking shall be of the color listed in TABLE I and the size listed in TABLE II. The arrows shall be installed adjacent to each band to indicate the direction of flow in the pipe. The legends shall be printed in upper-case black letters as listed in TABLE I. Letter sizes shall be as listed in TABLE II. Marking shall be painted or applied using colored, pressure-sensitive adhesive markers of standard manufacture. Paint shall be as specified for insulated and uninsulated piping.

TABLE I. COLOR CODES FOR MARKING PIPE

Material	Band	Letters and Arrow*	Legend
Cold water (potable)	Green	White	POTABLE WATER
Fire protection water	Red	White	FIRE PR. WATER
Fire Sprinkler Water	Red	White	FIRE SPR. WATER

TABLE I. COLOR CODES FOR MARKING PIPE

Material	Band	Arrow*	Letters and Legend
Hot water (domestic)	Green	White	H.W.
Hot water recirculating (domestic)	Green	White	H.W.R.
High temp. water supply	Yellow	Black	H.T.W.S.
High temp. water return	Yellow	Black	H.T.W.R.
Boiler feed water	Yellow	Black	B.F.
Low temp. water supply (heating)	Yellow	Black	L.T.W.S.
Low temp. water return (heating)	Yellow	Black	L.T.W.R.
Condenser water supply	Green	White	COND. W.S.
Condenser water return	Green	White	COND. W.R.
Chilled water supply	Green	White	C.H.W.S.
Chilled water return	Green	White	C.H.W.R.
Treated water	Green	White	TR. WATER
Chemical feed	Yellow	Black	CH. FEED
Compressed air	Blue	White	COMP. AIR
Natural gas	Yellow	Black	NAT. GAS
Propane Gas	Yellow	Black	PROP. GAS
Refrigerants	Blue	White	REFRIGERANT
Fuel oil	Yellow	Black	FUEL OIL
Steam	Yellow	Black	STEAM
Condensate	Yellow	Black	CONDENSATE
Hydraulic fluid under 4.1 MPa	Green	White	HYDRAULIC FLUID-_____PSI
Hydraulic fluid 4.1 MPa and Greater	Yellow	Black	HYDRAULIC FLUID-_____PSI

TABLE II. COLOR CODE MARKING SIZES

Outside Diameter of Pipe Covering (mm)	Width of Color Band (mm)	Arrow Length x Width (mm)	Size of Legend Letters and Numerals (mm)
Less than 38	200	200 x 57	13
38 to 60	200	200 x 57	19
60 to 150	300	200 x 57	31
200 to 225	600	300 x 110	63
Over 250	800	300 x 115	88

### 3.6 MISCELLANEOUS PAINTING

#### 3.6.1 Lettering

Lettering shall be provided as scheduled on the drawings, shall be block type, and shall be black enamel. Samples shall be approved before

application.

### 3.7 SURFACES TO BE PAINTED

Surfaces listed in the painting schedules at the end of this section, other than those listed in paragraph SURFACES NOT TO BE PAINTED, shall be painted as scheduled.

### 3.8 CLEANING

Cloths, cotton waste and other debris that might constitute a fire hazard shall be placed in closed metal containers and removed at the end of each day. Upon completion of the work, staging, scaffolding, and containers shall be removed from the site or destroyed in an approved manner. Paint and other deposits on adjacent surfaces shall be removed and the entire job left clean and acceptable.

### 3.9 PAINTING SCHEDULES

The following painting schedules identify the surfaces to be painted and prescribe the paint to be used and the number of coats of paint to be applied. Contractor options are indicated by -----or----- between optional systems or coats.

#### EXTERIOR PAINTING SCHEDULE

<u>Surfac</u>	<u>First Coa</u>	<u>Second Coa</u>	<u>Third Coat</u>
Concrete masonry units.	Cement-emulsion filler	FS TT-E-2784 Type III	None
	CID A-A-1500	FS TT-E-2784 Type III	None
	FS TT-E-2784 Type III	FS TT-E-2784 Type III	None

NOTE: Cement-emulsion filler coat shall be acrylic-based and shall consist of the following ingredients in the proportion stated: white portland cement, ASTM C 150, Type I, 7.5 kg; aggregate 15 kg; mixing liquid, factory-prepared acrylic containing 46 to 47 percent solids, 3 liters; potable water 4 liters maximum; exterior emulsion paint, FS TT-E-2784 Type III 4 liters. Aggregate shall consist of Washed silica sand of the following gradation:

Concrete, unless otherwise specified.	FS TT-E-2784 Type III	FS TT-E-2784 Type III	None
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## EXTERIOR PAINTING SCHEDULE

<u>Surfac</u>	<u>First Coa</u>	<u>Second Coa</u>	<u>Third Coat</u>
Wood, unless otherwise specified.	CID A-A-2336	FS TT-E-2784 Type II	FS TT-E-2784 Type II
	FS TT-E-2784 Type III	FS TT-E-2784 Type II	FS TT-E-2784 Type II
Wood: stain finish.	FS TT-S-708	None	None
	FS TT-S-001992 Class B	FS TT-S-001992 Class B	None
Ferrous metal unless otherwise specified	SSPC Paint 5	CID A-A-2962 Type I  Grade C	CID A-A-2962 Type 1  Grade C
Ferrous metal: subject to high temperature, from 232 degrees C to 649 degrees C (450 degrees F to 1200 degrees F)	FS TT-P-28	FS TT-P-28	None
NOTE: Commercial blast-cleaning, SSPC SP 6/NACE 3 required. No pretreatment. Maximum total system thickness: 0.102 mm.			
Galvanized metal.	FS TT-E-2784 Type III	FS TT-E-2784 Type II	FS TT-E-2784 Type II
Aluminum aluminum-alloy, and other non-ferrous metal (non-galvanized)	FS TT-P-645	FS TT-E-489	FS TT-E-489





## INTERIOR PAINTING SCHEDULE

<u>Surfac</u>	<u>First Coa</u>	<u>Second Coa</u>	<u>Third Coat</u>
Plaster, gypsum board, concrete, and concrete masonry units	CID A-A-2994 Type II	CID A-A-2246	CID A-A-2246 on gypsum board faced with recycled paper
not requiring a smooth finish, unless otherwise specified		-----or-----	-----or-----
		CID A-A-2247	CID A-A-2247 on gypsum board faced with recycled paper
		-----or-----	-----or-----
Concrete masonry units requiring a smooth finish	CID A-A-1500	CID A-A-2994 Type II	CID A-A-2246
			-----or-----
			CID A-A-2247
			-----or-----
Concrete: floors in Lobby and stairwells, requiring dust reduction, protection, and aesthetics.			CID A-A-2248
Concrete: Floors requiring dust reduction.	CID A-A-2542 Type I	None	None
Concrete masonry units in food-preparation, food-serving, restrooms and laundry areas, unless otherwise	CID A-A-1500	CID A-A-2994 Type II	FS TT-E-2784

specified

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Gypsum board

U.S. Gypsum Knockdown  
 Spray Texture Finish # 2  
 (Spatter Knockdown)  
 knockdown  
 finish in:  
 sleeping bays,  
 corridors, restrooms,  
 and as indicated on  
 Interior Finish Schedule

Gypsum board requiring a multi-color finish.      Zolatone multi-color, semi-glass, acrylic latex primer and finish coat installed per manufacturer's recommendations.

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Aluminum and aluminum alloy unless

CID A-A-2867

CID A-A-2867

None

otherwise specified.

FS TT-E-2784  
 Type III

FS TT-E-2784  
 Type II

FS TT-E-2784  
 Type II

---

Ferrous metal factory-primed mechanical and electrical equipment.

Two coats of paint as recommended by the equipment manufacturer

None

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Galvanized metal:

FS TT-E-2784  
 Type III

FS TT-E-2784  
 Type II

None

---

Wood: unless otherwise specified.

CID A-A-2994  
 Type I

CID A-A-2246

None

-----or-----

CID A-A-2247

None

-----or-----

CID A-A-2248

None

---

Wood: stain and varnish finishes as follows:

Commercially available stain

CID A-A-1788  
 Type II  
 Class I

CID A-A-1788  
 Type II  
 Class I

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Ferrous Metal:  
 Convector enclosures,

SSPC Paint 23

None

None

electrical  
conduit runs:  
metallic tubing  
uninsulated  
ducts and pipes,  
pipe hangers,  
louvers, grilles,  
and air outlets,  
in areas having  
painted adjacent  
surfaces.

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Aluminum and Galvanized Surface Metal:

Convector	FS TT-E-2784	CID A-A-2246	CID A-A-2246
enclosures,		-----or-----	
electrical		CID A-A-2247	CID A-A-2247
conduit runs		-----or-----	
metallic tubing		CID A-A-2248	CID A-A-2248
uninsulated			
ducts and pipes,			
pipe hangers,			
louvers, grilles,			
and air outlets,			
in areas having			
painted adjacent			
surfaces.			

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-- End of Section --

## SECTION 09910

## TEXTURED ACRYLIC WALLCOATING

05/99

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

## AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM E 84 (1991a) Surface Burning Characteristics  
of Building Materials

ASTM E 96 (1994) Water Vapor Transmission of  
Materials

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

## SD-03 Product Data

Acrylic Wallcoating; GA-KCD.

Manufacturer's descriptive data.

## SD-04 Samples

Acrylic Wallcoating; GA-KCD

Three samples of each indicated type, pattern, and color of acrylic wallcoating required. Samples shall be minimum 200 mm by 280 mm and of sufficient size to show pattern and texture.

## SD-06 Test Reports

Testing; GA-KCD

Reports of tests for conformance to all minimum performance characteristics as specified below. Each report shall be properly identified. The test methods used shall be identified and the test results shall be recorded.

#### SD-07 Certificates

Installer Qualifications; GA-RE.

Wallcoating manufacturer's certification of installer's qualifications.

#### SD-08 Manufacturer's Instructions

Installation; GA-RE.

Installation instructions for acrylic wallcoating.

#### Maintenance

Cleaning and maintenance instructions for acrylic wallcoating.

### 1.3 QUALITY ASSURANCE

#### 1.3.1 Material Source Responsibility

Provide primer and other undercoat materials which are produced or are specifically recommended by the same manufacturer as the finish materials to insure compatibility of the system. Use thinners approved by the coating manufacturer, and use only within recommended limits.

#### 1.3.2 Qualifications

All applicators must be factory trained and qualified to apply materials. Applicator shall submit a photocopy of factory certificate as proof of factory qualification. Certificate shall include individual names of individuals receiving certification and only those individuals shall be qualified to apply the material.

### 1.4 FIELD EXAMPLES

On a 1200 mm by 2400 mm substrate at the jobsite, the Contractor shall provide two samples of each specified color and texture to simulate actual conditions. Resubmit samples as requested by the Contracting Officer's representative until acceptable. On actual wall surfaces and other building components, duplicate approved finishes on an initial installation of 100 square feet of surface for approval by the Contracting Officer's representative. The approved field example shall establish the acceptable quality of work for the remaining installation.

### 1.5 DELIVERY AND STORAGE

Materials shall be delivered to the building site in original unopened containers. Materials shall be stored in accordance with the manufacturer's instructions in a clean dry area with temperature maintained above 16 degrees C.

## 1.6 ENVIRONMENTAL REQUIREMENTS

Areas to receive wallcoating shall be maintained at a temperature above 18 degrees C for 3 days before, during, and 3 days after application. Apply materials only when surface temperature is between 16 and 38 degrees C. If dry conditions cause rapid drying of materials before proper finishes can be complete, eliminate breezes, fans, or other air movements which contribute to the problem and if necessary dampen the substrate with finely misted water prior to application. Protect finishes from casual impact for a period of 48 hours after application and from heavy traffic for at least 3 days.

## PART 2 PRODUCTS

### 2.1 TEXTURED ACRYLIC WALLCOATING

Textured acrylic wallcoating shall be an aggregated acrylic based coating product which meets all the specifications and performance criteria contained herein. As a reference and an acceptable product shall be DUROPLEX products as manufactured by TRIARCH INDUSTRIES, INC., Houston, TX, 1-800-537-6111. Texture and color shall be as indicated on the drawings.

#### 2.1.1 Materials

Finished and fully cured (28 days) materials shall have the following:

##### 2.1.1.1 Performance Characteristics

Textured acrylic wallcoating shall have the following minimum performance characteristics:

Barcoll Hardness Index:	35.0 or greater
ASTM E 84 Flame Spread:	8.5 or less ASTM E 84
Smoke Contribution:	7.0 or less
FAA Vertical Burn Test	
#FAR 25.853 (b):	0.1 seconds or less
Water Vapor Permeance ASTM E 96, B	27.5 English Perms or greater
UPITT (LC50) for thermal decomposition	150 grams or greater
Scrubability (200 strokes of a stiff brush with soap & water	0.001 inches erosion or less
Material Warranty:(Coating Integrity)	10 years
Mold and Mildew Warranty	10 years

##### 2.1.1.2 Solvent Resistance Characteristics

Textured acrylic wallcoating shall have the following minimum solvent resistance (1 hour soak):

Water:	slight softening (*)
Detergent:	no change
Ethanol:	no change
Naptha:	no change

Ammonium Hydroxide:	slight softening (*)
Ethylene Glycol:	no change
Bleach (household):	slight softening (*)
409 Cleaner:	slight softening (*)
Paint Remover:	slight softening (*)
Mineral Spirits:	no change

\* Slight softening is noted to mean a temporary softening. Original hardness regained after drying.

#### 2.1.1.3 Stain Resistance

Textured acrylic wallcoating shall have the following minimum stain resistance (10 hour soak and wash with 409 Cleaner or bleach, and water):

Water:	no stain visible
Blood:	no visible stain
Urine:	no visible stain
Coffee:	no visible stain
Tea:	no visible stain
Blueberry:	no visible stain
Mustard:	no visible stain

#### 2.1.1.4 Mildew Resistance

Textured acrylic wallcoating shall have been tested to show no visible mildew after incubation for 90 days in 35 degrees C and 90 percent relative humidity under high contamination conditions.

#### 2.1.2 Color Pigments

Pigments shall be pure, non-fading and bleach resistant.

#### 2.1.3 Color Selection

Manufacturer shall provide a minimum of 80 factory colors to select from and shall also provide custom color service in order to match the colors indicated in the project drawings.

### 2.2 PRIMER

Primer, where required, shall be provided by or approved by the acrylic wallcoating manufacturer

## PART 3 EXECUTION

### 3.1 SURFACE PREPARATION

Perform preparation and cleaning procedures in accordance with the coating manufacturer's recommendations and as herein specified, for each particular substrate condition. Remove hardware, hardware accessories, plates, lighting fixtures and similar items in place and not to be finish coated, or provide masking or other protection prior to surface coating operations.

Reinstall removed items after coating installation is complete. Clean surfaces to be coated before applying materials. Remove oils and grease prior to mechanical cleaning. Program cleaning and coating so that contaminants from cleaning process will not fall into wet or newly coated surfaces.

#### 3.1.1 Drywall Surface Preparation

Prepare drywall to acceptable industry standards for hanging vinyl wallcovering. Remove excess gypsum compound dust. Remove all excess drywall mud at taped joints and all other locations to minimum thickness necessary for proper coating in accordance with industry standards. Do not prime or seal the drywall. Dampen surface slightly with light mist spray of water just prior to application of acrylic wallcoating materials.

#### 3.1.2 Cementitious Substrate Preparation

Prepare cementitious surfaces such as concrete, CMU, cement plaster, and etc. by cleaning as noted above. Patch all major holes, honeycombs, etc. using structural grout. Then grind, fill, and float smooth all form seams and other minor imperfections using a product provided by the acrylic wallcoating manufacturer or a product recommended by same, and allow to dry for the manufacturer's recommended period.

#### 3.2 MIXING AND THINNING

Coating material shall be premixed wet and with color already in the container. Mixing and thinning of acrylic wall coating shall be in strict accordance with manufacturer's recommendations.

#### 3.3 APPLICATION

Apply coating materials in accordance with the manufacturer's instructions and recommendations as required to achieve the appearance of the approved samples and performance specifications in locations as indicated on the drawings. Coating materials shall be used as a system which may include primers and undercoatings as required by the manufacturer's installation directions. Once sprayed applied, coating materials shall be "knocked down" using a trowel or other similar tool to avoid sharp peaks. Completed work shall be uniform in appearance and coverage and shall be free of holidays, spotting, laps, tool marks, runs, sags, or other surface imperfections. Final dry film thickness shall be a minimum of 20 mils thickness. Thickness shall be uniform throughout the installation including taped joints and other dissimilar substrate materials being covered.

#### 3.4 CLEAN-UP AND PROTECTION

During progress of work, remove from site discarded coating materials, rubbish, cans, and rags at the end of the day. Protect work of other trades, whether to be coated or not, against damage by coating work. Provide signs, barricades etc. as required to protect work from damage by others.



-- End of Section --

## SECTION 09911

## FIBERGLASS REINFORCED PLASTIC PANELS

06/93

## PART 1 GENERAL

## 1.1 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

## SD-02 Shop Drawings

## Submittal Drawings; GA-BK

Indicate thickness and dimension of parts; fastening and anchoring methods; detail and location of joints; including joints necessary to accommodate thermal movement.

## SD-03 Product Data

## Manufacturer's Literature

Two copies of manufacturer's literature for panel material.

## SD-04 Samples

## Panel Assembly; GA-BK

Two samples of each type assembly 200 mm x 250 mm.

## Finish; GA-BK

Two samples of each color of finish selected 75 mm x 125 mm.

## SD-07 Certificates

## Requirements Affidavit

Affidavit certifying material meets requirements specified.

## 1.2 QUALITY ASSURANCE

### 1.2.1 Panel Manufacturer

The panel Manufacturer shall have a minimum of 10 years experience.

### 1.2.2 Field Measurements

When possible, field measurements should be taken prior to completion of shop manufacturing and assembly.

### 1.2.3 Maximum Deviation

Maximum deviation from vertical and horizontal alignment of erected panels shall be 3.2 mm in 6.1 m.

## 1.3 SUBSTITUTIONS

### 1.3.1 Materials and Products

The materials and products specified in this section establish a standard of required function, dimension, appearance and quality to be met by any proposed substitution.

### 1.3.2 Written Requests

No substitution will be considered unless written request for the approval has been submitted by the bidder and has been received by the Architect 10 days prior to the date for the receipt of bids.

### 1.3.3 Request Preparation

Each request shall include the name of the materials and a complete description of the proposed materials, including test performance and any other information necessary for evaluation.

## 1.4 DELIVERY, STORAGE AND HANDLING

### 1.4.1 Finish and Edges

Protect finish and edges in accordance with panel manufacturer's recommendations.

### 1.4.2 Storage

Store materials in accordance with panel manufacturer's recommendations.

## PART 2 PRODUCTS

### 2.1 PANELS - LAMINATED PANELS - INTERIOR WALLS

#### 2.1.1 Cleancote

Cleancote, interior wall and ceiling cleanroom products as manufactured by Citadel.

#### 2.1.2 Alternatives

Acceptable alternatives include panels of similar composite construction, providing manufacturer has a minimum of 10 years of experience.

### 2.2 FINISH

2.2.1 Finish shall be suede, white melamine.

2.2.2 Color shall be as specified on interior finish schedule.

### 2.3 PANEL FABRICATION

#### 2.3.1 Composition

One layer melamine; one layer 4 mm thermoset resin; second layer melamine.

2.3.2 Water Absorption: 4.35 percent.

2.3.3 Elongation: 2.44 percent.

2.3.4 Flexural Strength: 1.35 k/sq.cm.

#### 2.3.5 Interior Base Finishes

2.3.6 Panel lines, breaks and angles shall be sharp, true and surfaces free from warp and buckly.

2.3.7 Panel thickness: 4 mm.

2.3.8 Panel weight: 5.9 k/sq.m

### 2.4 ACCESSORIES

#### 2.4.1 Infill Component

Recommended use as infill component. Related materials to complete installation as recommended by panel manufacturer.

#### 2.4.2 Sealants

Sealants shall be recommended by the panel manufacturer, or Polyurethane caulk with 20 year life expectancy: Tremco DyMonic, Sonneborn Sonolastic NP1, General electric Silpruf, or Dow Corning 695.

## PART 3 EXECUTION

### 3.1 INSTALLATION

Erect panels plumb, level and true. Anchor panels securely in place in accordance with installer's approved shop drawings. Conform to

manufacturer's instructions for installation attachment systems. Surfaces to receive panels shall be even, smooth, sound, clean, dry and free from defects detrimental to panel installation. Seal all joints as required using methods and materials as specified above.

-- End of Section --

## SECTION 09912

ACRYLIC LATEX CONCRETE STAIN AND  
CONCRETE STAIN SEALER  
**04/01**

## PART 1 GENERAL

## 1.1 PRODUCT DESCRIPTION

## 1.1.1 Acrylic Latex Concrete Stain

Acrylic latex concrete stain is a blend of the finest acrylic resins and pigments available which gives this product superior adhesion, good resistance to wet and dry abrasion, excellent color fastness, and excellent resistance to acid and alkali.

## 1.1.2 Concrete Stain Sealer

A solvent-based concrete stain formulated with acrylic resins designed for deep penetration, concrete stain sealer is resistant to salt spray, acids, alkali, water, ultraviolet rays, and wet or dry abrasion. The resin system, which has been specially formulated by a custom manufacturer, has a very high resistance to traffic, and the aromatic solvents incorporated into the system provide excellent penetration, flow and cure characteristics. Highly recommended for exterior use, the pigment system is alkali-proof and lightfast, so color will not fade or die-back prematurely.

## 1.2 APPLICABLE STANDARDS - CONCRETE STAIN SEALER

This product meets or exceeds applicable Federal Standard TT-C555B, HUD, ASTM 96-66, ASTM G23F, and Federal Standard 141.

## 1.3 LIMITATIONS - CONCRETE STAIN SEALER

This product should not be used on wood surfaces. Do not use on areas sensitive to solvent attack. Do not use on wet surfaces.

## PART 2 PRODUCTS (Not Applicable)

## PART 3 EXECUTION

## 3.1 ACRYLIC LATEX CONCRETE STAIN

## 3.1.1 Preparation

Before application of any new coating, dirt, grease, grime, and foreign materials should be removed and all exterior surfaces should be treated for mildew. It is imperative to etch concrete properly, especially very smooth and dense concrete.

### 3.1.2 Application

Mix the product thoroughly. Apply with brush, roller or spray. Apply when surface temperatures are at least 50 degrees F. Mask off baseboards and walls. Paint a 3-inch border around the edge while working. Begin at the corner farthest from the door. Saturate the roller with paint and lay it out in bold, criss-cross stroke, then make straight even strokes to smooth out the paint film. Roll into freshly brushed borders. Bring roller down lightly over wet paint in smooth even strokes. Work from dry area into wet areas in 3-foot sections. Do not thin with paint thinners. Tint only with recommended colorants. Do not allow water to stand on newly painted surface for one week.

Since this type of finish may become slippery when wet or when oil or grease is on the surface, in areas where this is a problem, a non-skid additive should be either mixed into or broadcast on the finish before it is allowed to dry.

### 3.1.3 Recommended Thinner

Acrylic latex concrete stain does not require thinning, except for the first coat on unpainted concrete. Should thinning become necessary, clean drinking water should be added only to achieve the required properties. About 1 to 2 pints of fresh water should be added per gallon of paint for the first coat on new concrete.

### 3.1.4 Recommended Primer Cement

New, unpainted or smoothly-worn concrete should be etched with a solution of 1 part muriatic acid to 8 parts water. Let stand 30 minutes. Scrub surface with a brush or stiff broom while rinsing to remove all residue. Let dry. Apply 2 coats of acrylic latex concrete stain with the first coat thinned back with water at the ratio of 1 pint of water to 1 gallon of stain.

### 3.1.5 Unpainted or Badly Worn Surfaces

Touch up badly worn spots on wood with a thinned first coat of acrylic latex concrete stain. Thin with 1 cup of water to 1 quart of stain for the first coat. Apply the second coat without thinning.

### 3.1.6 Recommended Uses

This product can be used for interior and exterior surfaces such as patios, floors, porches, walks, or wherever an outstanding abrasion resistant coating is desired. It can be used on floors of garages, carports, driveways, or other areas where automobiles will stand. Warm or hot tires could cause lifting of the stain film from the surface of the concrete if proper penetration was not achieved.

### 3.1.7 Application - Brush, Roll, or Spray

A 3/8-inch nap roller is recommended on smooth surfaces; a 1/2-inch to 1-inch nap is recommended for rough surfaces. For spraying, use a tip designed for application of bodied paints or contact a representative from

## Increte Systems.

## 3.1.8 Resistance

Dry Heat	Excellent
Alkali	Excellent
Yellowing	Excellent
Weather	Excellent
Moisture	Excellent
Industrial Fumes	Very Good
Mildew	Excellent

## 3.1.9 Coverage

Coverage will depend on porosity and contour of the surface to be coated. 117 sq.ft. per gallon at 2 mil DFT. The actual coverage will be less depending on application and color. Apply at 300-400 sq.ft. per gallon.

Finish:	Low Luster
Vehicle Type:	Acrylic Resins
Pigment Type:	Titanium Dioxide and Inert Pigments
Solvent Type:	Water
Flash Point:	Not Flammable

## 3.2 CONCRETE STAIN SEALER

## 3.2.1 Alternate Uses

Stamped Concrete Coating  
 Kool Deck or Keystone  
 Tennis Courts (Concrete Only)  
 Shuffleboard Courts  
 Swimming Pool Coating (highly resistant to water, acids and pH, either side of neutral)  
 Properly-prepared Steel Surfaces  
 As a Water Proof, Sun Proof, Decorative Top Coating for Masonry Roofs and Walls

## 3.2.2 Colors

Concrete stain sealer is supplied in a wide variety of read-mixed colors. Color charts are available upon request.

## 3.2.3 Preparation

Concrete must be at least 10 days old. All old paint, oil, and grease must be removed. Most concrete must be etched as a porous surface is required. Etching should be done with a 6 part water to 1 part muriatic acid solution. Extremely hard or polished concrete may require a second application with stronger solution. Rinse surface thoroughly with plenty of clean water and let dry completely. Always stir stain well before use, and during application to prevent settling and ensure proper dispersion of colorant.

## 3.2.4 Application



## 3.2.4.1 Roller Application

For the first coat only, reduce stain 8:1 with Stain Reducer (use more reducer if surface is dense). Do not pour Concrete Stain Sealer directly on surface. Use a solvent-resistant roller. To help eliminate bubbling, saturate roller thoroughly before starting. Apply stain at a rate not to exceed 250 sq.ft. per gallon. Use a roller pan or a grid to remove excess stain. A second coat should be applied after the first coat has completely dried, usually after a minimum of 1 to 2 hours.

## 3.2.4.2 Spray Application

Use an airless sprayer with a medium tip size and very low pressure. If conditions are windy or extremely hot, adjust technique to avoid "dry spraying" the surface. A second coat should be sprayed after the first coat is dry.

## 3.2.5 Cleanup

Use toluene, xylene, or Increte Stain Reducer for cleaning tools.

## 3.2.6 Technical Data

Specific Gravity:	0.95-1.1
Non-Volatile (wt):	35-40%
Wetherometer G23F Type:	2000+hrs.
Moisture Vapor Permeability:	0.001
Hurricane Force Water:	no effect
Abrasion Resistance:	12.5g. loss
Toukon Hardness:	12 (KHN)
Glass transition Temperature:	50 Degrees C.
Flash Point:	65 Degrees F.
Coverage:	250 sq.ft./gl

Acid and alkali resistance test: Each sample was allowed to react for 24 hours under a watch glass, washed with water, allowed to recover for 30 minutes then observed 3.2.6.1 Alkali

2% NaOH	Slight Dulling
5% Tide	No Effect
2% Ivory	No Effect

## 3.2.6.2 Acid

5% Citric Acid	No Effect
Milk (Lactic Acid)	Slight Discoloration
5% HCl	Slight Discoloration
5% Phosphoric Acid	No Effect
Mustard	Slight Stain
Ketchup	No Effect

-- End of Section --

## SECTION 09920

## CONTRACTOR COLOR BOARDS

08/99

## PART 1 GENERAL

## 1.1 GENERAL

This section covers only the color of the exterior and interior materials and products that are exposed to view in the finished construction. Reference the INTERIOR FINISH MATERIALS LEGEND in the drawings for those interior finishes and items requiring color selection. The word "color" as used herein includes surface color and pattern. Requirements for quality and method of installation are covered in other appropriate sections of the specifications. Specific locations where the various materials are required are shown on the drawings. Items not designated for color in this section may be specified in other sections. When color is not designated for items, the Contractor shall propose a color for approval.

## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

SD-04 Samples

Color board; GA-KCD (One Set) GA-RE (Two Sets).

3 sets of color boards, 120 days after the Contractor is given Notice to proceed.

## PART 2 PRODUCTS

## 2.1 COLORBOARDS

## 2.2 Binder Cover

All colorboards shall be presented in a set of 3-ring "D" binders large enough to adequately hold all colorboards. Binders shall include plastic sleeves on the front and spine to accept contractor supplied inserts with the project name, number, and date.

### 2.3 Boards

The colorboards shall be fabricated from presentation (mat) board with a rigid substrate such as 1/8-inch foam core board to provide a stable surface for sample attachment.

### 2.4 Samples

Colorboard samples shall reflect all actual finish textures, patterns, and colors required for this contract as specified in the Interior Finish Schedule, Exterior Finish Schedule, and the Interior Finish Materials Legend found in the contract drawings. Patterned samples shall be of sufficient size to adequately show the pattern and its repeat if a repeat occurs.

### 2.5 Sample Labeling

All samples shall be labeled on the colorboards with the manufacturer's name, and the pattern and color name and number. Samples shall also be keyed or coded to match any key or code system used in the contract drawings.

### 2.6 REFERENCE TO MANUFACTURER'S COLOR

Manufacturers specified in the contract drawings are not intended to limit the selection of equal colors from other manufacturers. Where color is shown as being specific to one manufacturer in the contract drawings, an equivalent color by another manufacturer may be submitted for approval. Variances from the manufacturer listed in the contract drawings must be annotated and highlighted for review.

### 2.7 MATERIAL QUALITY

Samples submitted as part of the contractor color boards are for color, pattern, and texture approval only. Material quality including specifications and performance requirements shall be reviewed as part of the material's individual submittal section as shown in the submittal register as part of 01330, Submittal Procedures. Samples approved as part of the color board submittal may be disapproved at a later date if, after review, specifications or performance characteristics do not meet the project requirements.

## PART 3 EXECUTION

### 3.1 MOUNTING

All samples shall be securely mounted to the presentation boards using hot-melt glue or other permanent adhesive which will insure the samples will not come loose during shipping or use.

-- End of Section --

## SECTION 09930

DECORATIVE ACIDIC-BASED CONCRETE STAIN AND FINISH  
04/01

## PART 1 GENERAL

## 1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. Concrete shall comply with provisions of the following standards, except where more stringent requirements are indicated.

## AMERICAN CONCRETE INSTITUTE (ACI)

ACI 318	Building Code Requirements for Reinforced Concrete
ACI 305R	Hot Weather Concreting
ACI 306R	Cold Weather Concreting

## Concrete Reinforcing Steel Institute (CRSI)

CRSI	Manual of Standard Practice
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## American Society for Testing and Materials (ASTM)

ASTM C309	Liquid Membrane-Forming Compounds for Curing Concrete
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## 1.2 SUBMITTALS

Government approval is required for submittals with a "GA" designation; submittals not having a "G" designation are for information only. All items designated with a "GA" or "GA-AO", "GA-BK", "GA-CH", "GA-DN", "GA-HQ", including product literature, calculations, component data, certificates, diagrams and drawings, shall be submitted concurrently in one complete system submittal. Omission of any required submittal item from the package shall be sufficient cause for disapproval of the entire submittal. Unless otherwise indicated in the submittal review commentary, disapproval of any item within the package shall require a re-submittal of the entire system package, in which all deficiencies shall be corrected. The following shall be submitted in accordance with Section 01330 "SUBMITTAL PROCEDURES":

SD-02 Shop Drawings

Shop Drawings; GA-KC.

Submit shop drawings indicating joint spacing and locations. If there are control joints, blend them into the pattern.

#### SD-03 Product Data

Product Data; GA-KC.

Submit product data for review, including acid-based stains, sealers, cementitious overlays, and curing compounds.

#### SD-04 Samples

Product Samples; GA-KC.

Submit product samples for review, including acid-based stains, sealers, cementitious overlays, and curing compounds.

Sample Color Chips; GA-KC.

Submit acid stain manufacturer's sample chips of specified colors indicating cutting ratio, if any. Color selection may vary somewhat from concrete finished in field according to specifications.

#### SD-08 Manufacturer's Instructions

Design Mixes; GA-KC.

Submit design mixes for each class of concrete. Include revised mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustment.

### 1.3 QUALITY ASSURANCE

#### 1.3.1 Installer

Engage an installer/applicator who is factory trained by the manufacturer specializing in decorative concrete work.

#### 1.3.2 Field-Constructed Mock-Up

Prior to installation of acid based stain work, erect 1800 mm x 1800 mm sample panels in place to further verify selections.

##### 1.3.2.1 Full-Scale Mock-up

Provide full-scale mock-up under provisions of Section 01400. Construct at least one month before start of other concrete work to allow concrete to cure before observation.

##### 1.3.2.2 Demonstration of Condition

Mock-up shall demonstrate each forming and finishing condition required on project using materials, workmanship, joint treatment, form ties, curing

method and patching techniques to be used throughout project.

#### 1.3.2.3 Retention of Samples

Retain samples of cements and aggregates used in mockup for comparison with materials used in remaining work.

#### 1.3.2.4 Accepted Mock-Up

Keep accepted mock-up undisturbed during construction as a standard for judging completed work.

#### 1.3.3 Pre-Installation Conference

Conduct conference at project site to comply with requirements of Section 01200. Before installing acidic-based stained concrete, meet with representative of authorities having jurisdiction. Notify participants at least 3 working days before conference.

#### 1.3.4 Delivery, Storage and Handling

Obtain each material from the same source to maintain a high degree of consistency in workmanship throughout project. Store stain and sealer in a dry area with a temperature above freezing.

### PART 2 PRODUCTS

#### 2.1 FORMS

Form Materials: Provide smooth, non-porous surfaces such as steel, plastic, or high-density overlaid plywood to provide full-depth, continuous, straight, smooth exposed surfaces.

#### 2.2 MATERIALS

##### 2.2.1 Acidic-Based Stain

Pre-packaged acidic based stain containing colorfast metallic salts. Color as indicated on the Interior Finish Schedule. All products listed in the materials section shall be identical to those manufactured by Increte Systems Inc. PO Box 1343, Sedalia, MO. Contact Mr. Kevin Haulotte at 877-826-4315, or 800-752-4626. Stain-crete will be packaged in one and five gallon ready to use containers.

##### 2.2.2 Cementitious Overlay

Prepackaged acrylic modified self-leveling overlay system compatible with acidic based stain. Packaged in 50 lb. Bags.

##### 2.2.3 Portland Cement

ASTM C 150, type I (gray) (white). Use one brand of cement throughout project unless otherwise specified.

#### 2.2.4 Fly Ash

ASTM C618, Type F

#### 2.2.5 Normal-Weight Aggregates

Provide aggregates from a single source, ASTM C 33, Class 4, as follows. Do not use fine or coarse aggregates that contain substances that cause spalling. Local aggregates not complying with ASTM C 33 that have been shown to produce concrete of adequate strength durability by special tests or actual service may be used when approved.

#### 2.2.6 Water

Potable

#### 2.2.7 Fiber Reinforcement

Synthetic fibers engineered and designed for secondary reinforcement of concrete slabs, complying with ASTM C 1116, Type III. Provide "mono fiber" manufactured by Increte Systems, Inc.

#### 2.2.8 Sand

Color shall be locally available.

#### 2.2.9 Admixtures

Do not use calcium chloride admixtures.

### 2.3 ACCESSORIES

#### 2.3.1 Curing Compound

Curing compound shall comply with ASTM C 309 and be approved by stain manufacturer for use with acidic based stain. Provide "Cure-Crete" manufactured by Increte Systems Inc.

#### 2.3.2 Sealant

Joint sealers shall be type specified in Section 07900. Provide in color matching colored concrete.

#### 2.3.3 Sealer

Acrylic-based sealer manufactured by Increte Systems, Inc., or compatible.

## PART 3 EXECUTION

### 3.1 FLOOR FINISHES

#### 3.1.1 Trowel

Use steel trowel to produce smooth surface. Do not over-trowel or start troweling late.

#### 3.1.2 Overlay

Mix and apply overlay material per manufacturer's directions.

### 3.2 PATCHING

Use the same patching materials and techniques that were approved on mock-up. Make patches with a stiff mortar made with materials from the same sources as the concrete. Adjust mortar mix proportions so dry patch matches dry adjacent concrete. Add white cement to mortar mix if necessary to lighten it.

### 3.3 CURING

#### 3.3.1 Curing

Maintain concrete between 65 and 85 F (18 to 29 C) degrees during curing. (Curing with water, membranes, or non-approved compounds can discolor concrete.)

#### 3.3.2 Colored Concrete

Apply curing compound in accordance with manufacturer's instructions.

### 3.4 APPLICATION STEPS

#### 3.4.1 Staining

Acidic Based Stain: Stain shall be applied per manufacturers direction on a clean concrete surface that is a minimum of 14 days old. When stain is applied over a overlay system the surface must be a minimum of 3 days old. All staining techniques must be the same as the approved mock-up. Variegated appearance of stained concrete is acceptable.

#### 3.4.2 Seal

Apply Clear Seal sealer per manufacturer's directions after the surface has thoroughly dried.

#### 3.4.3 Water Saw Cut

Water saw cut pattern per drawings, with 6 mm (1/4") wide diamond blade, to a depth of 3 mm (1/8").

#### 3.4.4 Second Sealer

Apply second coat of Clear Seal sealer per manufacturer's directions.

#### 3.4.5 Glaze



Apply Inco Glaze high solids glaze coat per manufacturer's directions.

3.4.6 Wax

Apply a final coat of Increte was per manufacturers instructions. Let stand 4-6 hours then cover and protect until ready to use.

-- End of Section --